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	Page
British Engineers under Foreign Laws	217
Baltimore Oil-switch Tests	218
Transatlantic Cable Communications	219
The German Electrical Industry...	219
The Glasgow Electricity Undertaking	219
The Proposed Visit to Gennevilliers	219
Aluminium Overhead Transmission Lines (*illus.*)	220
75,000-h.p. Natural Gas-fired Power Plant (*illus.*)	222
Steampipe Arrangements, by Edward Ingham	224
Leaves from an Inspector's Notebook	226
The Effect of Heat on the Electric Strength of Some Commercial Insulating Materials, by W. S. Flight	227
New Electrical Devices, Fittings, and Plant (*illus.*)	228
Legal...	229
Correspondence—	
A Breach of Confidence	229
Small Private Generating Stations	229
Electrical Supplies in South America	229
Sale of Wireless Apparatus	229
Removal of Static Charge	230
The Registration of Contractors	230
Business Notes	230
Notes	236
City Notes	240
Stocks and Shares	242
False Marking and Description of Goods, with Special Reference to Origin, by Theodore Rich (*continued*)... ...	243
Electricity Districts	245
The Baltimore Oil-circuit-breaker Tests...	246
The Spanish Market	247
A Large Condensing Plant (*illus.*)	248
Electrification of Netherlands Railways	249
The Glasgow Electric Undertaking	250
Reviews	250
New Patents...	252
Published Specifications	252
Contractors' Column ... ... Advertisement page xxviii	

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BRITISH ENGINEERS UNDER FOREIGN LAWS.

ALMOST all over the world and extending back for many, many years, British engineering firms and contractors for public and private works of various kinds have carried out undertakings in different countries which have earned for them a reputation that is unsurpassed, if indeed equalled, by that of any of their competitors of any other nationality who at a much later date embarked upon similar enterprises. In the course of this work a large amount of experience has been gained of the commercial laws of the foreign countries concerned in so far as they were applicable to the works which were executed, and the information thus obtained has naturally been carefully safeguarded by the parties concerned in the interests of possible developments in the same parts of the world in the future. Private enterprise, in fact, and almost invariably without any assistance from the State, has always been the basis of the success of British engineers all over the globe.

The preceding reflections have been evoked by the announcement that an American inquiry is now being officially made into the legal requirements of American engineers and contractors in the matter of operations carried out in other countries. Some time ago a Division of Commercial Laws was created within the United States Department of Commerce for the express purpose of compiling and distributing information on the working of foreign laws abroad as affecting the conduct of business in other countries by American firms domiciled in the United States. At the outset the Department of Commerce intended that the Division should make an investigation into those legal problems which are encountered by the representatives of American firms who betake themselves to a foreign country for a limited period to execute an engineering contract of one kind or another. As is quite obvious, immediately on arrival the supervising or erecting engineer finds himself in contact with foreign laws. His position is very different from that of the resident manager of the branch of a commercial firm; yet his contact with local laws is more direct and more fruitful of possibilities of difficulties. With a view to throwing light on the situation of the American engineer abroad, and at the suggestion of an American company, the Division decided to make an inquiry on the question, and for this purpose a questionnaire was prepared, which was sent last April to the "field men" of the Department of Commerce and also to American Consular officials in a number of selected countries.

The principal points embodied in the questionnaire were:—

1. Is it advisable for engineering companies which undertake temporary contracts in your territory for official or private interests to obtain domestication or to register their company?

2. How is this effected?

3. Will it suffice for the engineer in charge, with power of attorney, to register as an individual?

4. What taxes must the company pay? (In answering that question bear in mind that the company undertakes the work at a fixed price payable in part before the work is started and the balance after the work is completed. Profits cannot be determined until the work is finished.)

5. Describe the liability for injury to labourers under the laws of your territory. Can insurance be obtained for this liability? Can contractors' insurance be secured?

It appears that down to the beginning of June replies to the questionnaire had been received from the American acting commercial attaché at Havana in relation to Cuba and from the American Consul in Mexico City with regard to Mexico, while other replies are being awaited by the Division of Commercial Laws.

Apparently the investigation only covers the situation of the legal obligations of the contracting company and its supervising engineer, and it does not include the position of the travelling representative who is sent out to work up business in the direction of a contract for State, municipal, or private account. Yet it seems necessary for the travelling engineering representative to familiarise himself, apart from the language of the country, with such legal conditions as apply to himself in the matters of temporary permits, trading licences, &c., and in order to enable him, as far as possible, to make sure that any contracts entered into are also legally binding upon the other parties concerned. While much may be learned from Consular or other commercial officials, there are other ways in which information respecting the responsibilities and liabilities of representatives and of their companies should be procurable. In the first place, there are the foreign Consuls and other foreign commercial organisations in London; secondly, there are foreign attorneys in London who understand the commercial laws of their respective countries; and in the third place there are the large banking institutions whose wealth of information concerning the trading conditions and the legal obligations of traders and contractors, which apply to the overseas countries where the banks have maintained branches for many years past, is no doubt available to clients or others who seek development in transmarine countries.

On the other hand, the travelling engineer or the supervising engineer on reaching a foreign country is able to apply, as already mentioned, to the British Consulates, Legations or Embassies; the firm he represents no doubt possesses commercial relations with overseas firms from which much useful knowledge may be obtained; the English managers of the local branches of English banks also come into consideration for procuring information; and it is open for the representative to consult an approved native attorney in the country where he intends to stay for a temporary period.

That the sources above mentioned have been utilised by British engineers in the past is highly probable; we merely recall them in order to show that certain paths are already open for the purpose in view. But it would appear to be impossible in every case to draw up a set of rules and information for the safe guidance of engineers and contractors or their representatives in different countries, so as to apply in general to the whole of one country concerned, as, for instance, Mexico and Brazil, on account of the existence of local or State laws. Thus in Brazil, besides the laws of the Federal Government, there are those of the different States, each of which is able to raise a loan on its own account, but the Federal Government assumes no responsibility for the payment of the interest or the redemption of the debt.

The most prudent course for engineers to follow, after having exhausted all sources available in England, would appear to be to take advantage of the overseas facilities already mentioned. In some cases it may cost money, but such expenditure is generally a profitable investment, as the resident Germans representing German industrial works in South America found out long ago, when they began the practice of making contributions of single sums of from £50 to £100 occasionally to local charities or public institutions, which they notified to headquarters, being credited with the amounts thus disbursed. Certainly those who are well equipped with the requisite information under consideration should be better able to transact business and execute contracts than those who are not so endowed, and it therefore devolves upon firms and companies which are interested to see to it that their representatives are fully armed with the necessary powers and the required information in order to ensure the success of their efforts in the acquisition of business and the fulfilment of contracts with the greatest facility and with the prospect of the minimum amount of friction with foreign authorities or private interests.

Baltimore Oil Switch Tests.

The high degree of reliability and continuity of service that users of electricity generally expect in this country makes it imperative to insist upon every section of the plant that supplies and distributes electricity maintaining a high standard of performance. It is realised that the astonishing growth of electric power systems, by necessitating a corresponding increase in the size of their components, *i.e.*, generators, transformers, cables, and other station equipment, has considerably augmented the burden that the switchgear has to carry. Moreover, the tendency to interconnect the older systems still further increases the duty that switching apparatus is called upon to undertake.

In view of these facts, it is not surprising that grave doubts exist as to the adequacy of the older types of oil circuit breakers at present in service for the heavy duty they may have to assume, whilst considerable uncertainty is felt concerning the actual rating of many of the more modern types of breaker. Even when a breaker does function properly it generally requires repairs or adjustments of some kind before it can be relied upon to clear a second fault, and this limitation of the number of times a circuit-breaker will satisfactorily interrupt heavy currents is indeed a serious drawback. The lack of exact knowledge as to the individual performance and rating of switchgear places the selection of the proper type and size of new equipment on an uncertain basis—a most undesirable condition when the size of, and investment involved in, modern undertakings are considered.

That this situation exists may be said to be largely due to the fact that manufacturers of switchgear are handicapped so far as the making of adequate tests is concerned. Tests are, of course, made, but they are generally few in number, or involve relatively small capacity. Manufacturers are naturally unable to reproduce the short-circuit conditions under which their products are required to function in practice.

Under the circumstances the elaborate series of oil circuit-breaker tests that have been carried out at Baltimore are of particular significance. Elsewhere in this issue it will be learned that a total of some 200 three-phase metallic short circuits were made directly on the Baltimore 13,200-volt, 25-cycle, power system, which the switchgear under test was called on to clear. The maximum generating capacity behind the short circuits was 170,000 kW, and the currents interrupted during the tests varied from 750 to 23,700 r.m.s. amperes.

The most interesting feature of the experiment is the fact that it has been proved to be possible to conduct such tests directly on a modern power supply system without damaging its equipment and without seriously interfer-

ing with its normal operation—a result which is undoubtedly due to the short duration of the short circuits, never more than 0.5 second, and to the fact that the system is equipped with a carefully designed and adjusted selective relay system.

The individual performances of the circuit breakers are said to indicate that it is possible to design and build switchgear which can be relied upon satisfactorily to interrupt large currents on large-capacity systems many times in succession without damage to the breaker, without oil throw, and without a change of oil or other adjustments being necessary.

Transatlantic Cable Communication.

The importance of accurate, prompt, and rapid communication by telegraphic means in times of peace and war, whether it be for business purposes or for naval or military operations, is universally recognised. The situation which arose last week as the result of the interruption of the cable and wireless telegraphic communication between Ireland and America should therefore be a significant warning.

Three weeks ago the large wireless station at Clifden, Co. Galway, was destroyed; last week the ten British submarine cables which connect British North America directly to the west coast of Ireland, in the neighbourhood of Valentia, were cut by Irish "Republican Irregulars" and the transmitting and receiving instruments either damaged or destroyed—the result being that this country is left with only three direct cables to America, which terminate at Penzance, Cornwall.

The reason which led the Irregulars to this action is not clear; the indignation of the American business world is no less than that of the general public whose widespread disapproval is summed up in the remarks that: "Mr. de Valera's mad Irish are making an international nuisance of themselves. They will, if possible, be more unpopular and more thoroughly discredited on this side of the Atlantic than they have ever been. If they persist, they will stir up a hornets' nest that will give them more trouble in a minute than Free State men can give them in a week." At a time when they are counting on American sympathy and support, the rebels' latest action seems to be singularly ill-advised; its only effects have been seriously to embarrass communication and to throw a number of their fellow-countrymen out of employment.

When the cables were landed on the west coast of Ireland, that country was an integral part of the United Kingdom and there was no serious risk of interference with them. With the constitution of the Irish Free State Provisional Government, however, the situation has radically changed, and the only way of freeing this country of what threatens to prove a serious handicap, would seem to be to transfer all vital arteries of communication with the Western Hemisphere direct to British soil and so place them out of reach of malicious damage. Happily, the situation has improved, and a considerably better service is available now, as compared with what was possible last week.

The German Electrical Industry.

The Rhenish electrical engineering group recently held a general meeting, when the secretary presented a report on the existing situation. The report stated that according to the guiding lines laid down by the Central Union of the Electrical Industry, the industry still calculates orders at the prices fixed on the date of the placing of the contracts in so far as the orders are executed within two months, which system is contrary to the practice of other industries. In the case of orders, the execution of which requires a period of longer than two months, the Central Union stipulates that these prices are to be calculated according to the arithmetical system of the percentage additions fixed every month to meet the increased costs of production. The Rhenish group contends that at a time when the depreciation of the currency proceeds in leaps and bounds and raw materials, such as castings, bars, sheets, textiles, copper, &c., have to be purchased at the ruling prices of the day, the following of the lines of the Central Union must lead to considerable losses. It is therefore suggested that this system should be abandoned as speedily as possible, that it should be replaced by invoicing at the prices prevailing on the day of delivery, and that the method of granting credits must be discontinued under any circumstances if the electrical industry is to continue to possess vitality.

The Glasgow Electricity Undertaking.

One of the largest electricity supply businesses in the United Kingdom, that of Glasgow, has just emerged from the most successful year of its history. The past year's working showed a net profit of £42,578, the whole of which has been transferred to reserve—a very wise policy. The most striking feature in the annual report is the enormous reduction in generating costs. Although the production of energy decreased, the decrease does not account for the very low figure recorded. As mentioned in our review of the report, the fuel cost was practically halved. No doubt the increased efficiency gained by the working of the up-to-date Dalmarnock station has a great deal to do with the result, but there is nothing in the report to show the fuel expenditure per kWh produced. In all probability the efficient method of coal handling and checking in use at Dalmarnock, aided by Mr. R. H. Parson's system of blotting a monthly boiler-house comparative efficiency diagram, has helped to attain this satisfactory result. It is significant also that a testing engineer, who is provided with complete testing equipment, is employed solely for the purpose of investigating problems connected with the economical operation of the station. The cost of coal must have been considerably lower, but it is to be noted that notwithstanding increased efficiency the cost of fuel per kWh sold remained at double the 1914-15 figure. Wages underwent a substantial reduction, and the decreases which occurred in other items appear amply to justify the institution of a scale of reduced charges by the Electricity Committee. The Glasgow supply is certainly "abundant," and compared with the majority of undertakings is very "cheap." We congratulate Glasgow on the result, and hope for an even better outcome from the current year.

The Proposed Visit to Gennevilliers.

As intimated in our last issue, the visit to the Gennevilliers station cannot take place before the end of the first week in October. We are now endeavouring to complete arrangements for an extended visit to the reconstructed areas of the North (particularly in the Lens district), which already contain magnificent new power stations and an astonishing network of extra-high-pressure overhead lines, together with a vast amount of new work of general engineering interest. We have spent some days recently in personally surveying the area referred to, and are satisfied that all that has been said regarding the work carried out during and since the war by our French allies falls short of the truth; not only as a matter of personal interest, but still more on the ground of technical progress, it is of the first importance that British engineers should make themselves acquainted with the methods and material employed in the reconstruction of the generating stations and transmission lines, and in the development of entirely new undertakings for the supply of electricity over large areas at the lowest cost compatible with reliability and efficiency. The number of engineers who have intimated their intention of becoming members of the party has already reached practically the limit which can be readily handled on a Continental visit. If there are any others who have not yet communicated their intention to join the party, their names should be sent in at once, as it will now be necessary for us to complete all arrangements and to advise the French companies of the numbers attending.

D

ALUMINIUM OVERHEAD TRANSMISSION LINES.

[Communicated.]

Aluminium as an electrical conductor has been in use for well over 20 years, and its special characteristics as a material for overhead transmission lines are generally well known. The development of aluminium cables having a core of steel, however, has of recent years drawn special attention to this alternative to copper, especially as a very large proportion of the most important modern transmission lines employ this form of cable, and an examination of the reasons which have led to the choice of steel-cored aluminium cables in these cases becomes of particular interest in view of the possibility of extensive developments of overhead transmission in this country that will probably follow the revision, now under consideration, of the existing overhead line regulations.

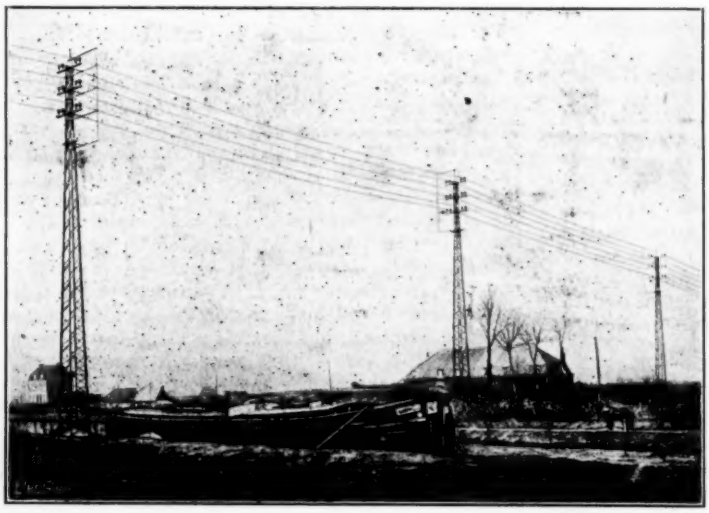


Fig. 1.—Section of the 45,000-volt French State Lines, Carrying Two Circuits of Steel-cored Aluminium Cable on Narrow Base, Lattice Steel Supports.

Before describing the particular advantages of steel-cored aluminium it is desirable briefly to refer to the chief characteristics of plain aluminium cables, in order to show in what way they are influenced by the presence of the steel core.

The chief claim for aluminium as an alternative to copper is that of economy. Although aluminium has a higher specific resistance than copper and, for the same conductance, the section must be about 64 per cent. greater, the specific gravity of aluminium is less than one-third that for copper and, in consequence, the weight of an aluminium cable is almost exactly one-half that of a copper cable of the same resistance and length. If, therefore, the cost of aluminium cable per ton is less than *twice* the cost per ton of copper cable, the aluminium one will be cheaper. The actual extent of the economy depends on various factors, but it is usually substantial, and may be as high as 25 per cent.

On the other hand, the tensile strengths of aluminium and copper cables of the same resistance are in the proportion of 82 to 100 and, in addition, the wind pressure will be greater on the aluminium cable owing to its larger diameter. The result is that the sag of an aluminium line will, in general, be greater than that of a copper line, so that the supports required may be both higher and stronger, and the saving on the conductors may be reduced, to some extent, by some extra cost of the supports. The difference between the costs of the supports to carry copper and aluminium cables decreases as the size of the conductor increases, and as the span length increases. Plain aluminium cables, therefore, have their greatest field of usefulness in schemes involving fairly large sizes of conductor and span lengths not exceeding two or three hundred feet.

For long-distance transmission, modern practice is to use span lengths of 500 ft. and over, not only because that figure gives the most economical construction, but also because the reduction in the number of supports and insulators reduces the number of points of possible breakdown. Moreover, the perfection of high-pressure switchgear, and the big strides which have been made in the development of insulators, have made available working pressures up to 220,000 volts, and the tendency is, therefore, to reduce the size of the conductors required to carry the power. If follows that long-distance transmission involves the very conditions under which aluminium cables show the least advantage—namely, long span lengths and small conductors, but even under these conditions aluminium is worth while, and there are several long-distance transmission lines of plain aluminium cables in America, Japan, New Zealand, and elsewhere.

For most modern long-distance schemes, however, the most suitable type of conductor is an aluminium stranded cable in which the central strands are of high-grade steel. Such a composite cable shows to the best advantage with long spans and with small sizes of conductors.

The steel strands are not regarded as contributing towards the current-carrying capacity of the cable, and the resistance is taken as the resistance of the aluminium strands alone. Hence, a steel-cored aluminium cable is of even larger diameter than the equivalent plain aluminium cable, and the supports must withstand an even larger wind pressure. Further, the addition of a core of steel obviously increases the cost and reduces the economy over copper. Why, then, with these apparent disadvantages, are steel-cored aluminium cables adopted

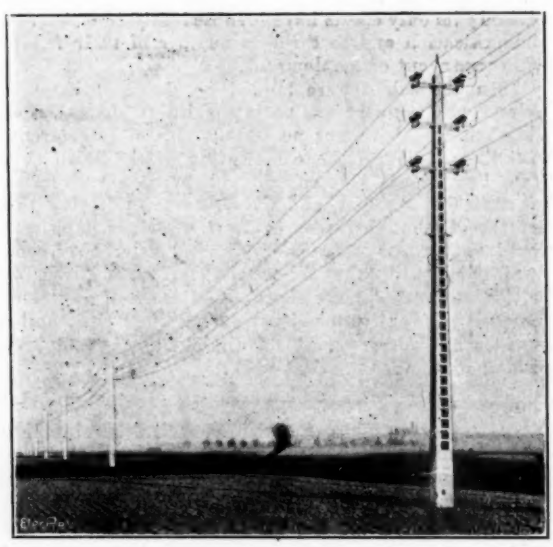


Fig. 2.—Ferro-concrete Supports with Steel-cored Aluminium Conductors, as Used in Northern France.

on the longest transmission lines and the largest high-pressure networks in the world?

The answer to that question is the fact that steel-cored aluminium conductors are from 55 to 65 per cent. stronger than copper cables of the same resistance and, at the same time, are from 16 to 26 per cent. lighter. The sum effect is that the sag with any particular factor of safety and loading conditions will be very considerably less than that of the equivalent copper conductors erected on the same span length, and hence the most economical span length with steel-cored aluminium cables is far larger. Thus, although the increased diameter necessitates an increase in the strength of the supports, the number of supports required per mile is reduced, and, taking both effects into consideration, it is found that the use of steel-cored aluminium cables enables a very considerable economy to be obtained in the total cost of supports and insulators and also in the costs of erection. In addition, although the steel must be paid for out of the saving on the aluminium part of the conductor, there is nevertheless an appreciable economy on the conductors themselves in comparison with copper, and the composite cable therefore scores as regards economy on all the chief items of the line.

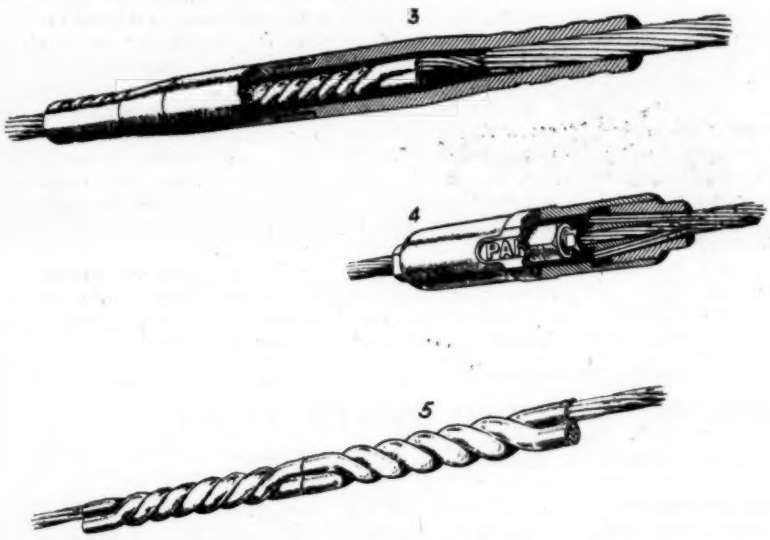


Fig. 3.—Two-piece Compression Joint for Large Steel-cored Aluminium Cables.
Fig. 4.—"Pairard" Cone-type Connector for Steel-cored Aluminium Cables.
Fig. 5.—Double McIntyre Sleeve Joint for Steel-cored Aluminium Cables.

It is interesting to note that in the transmission line now being erected in Australia in connection with the Morwell brown coal scheme, the adoption of steel-cored aluminium conductors has enabled the span length to be fixed at 1,054 ft., which is at present the longest average span length in the world. It is not suggested that in this country such span lengths will be possible even for the long-distance transmission lines which would be associated with any schemes for the utilisation of the water-power resources of Wales or Scotland. The crossing of cultivated land will necessarily restrict the space available for tower foundations, and long-distance transmission schemes in this country will probably be carried out on narrow base supports, such as those shown in fig. 1, or possibly on ferro-concrete supports as illustrated in fig. 2. The same principles will apply, however; and while with copper conductors it may be necessary to place a support in the centre of a large ploughed field, or to divert the line round the field, with steel-cored aluminium cables, in most cases, there will be no difficulty in crossing in a direct line with supports at the hedges.

The fact that the diameter of a steel-cored aluminium cable is greater than that of the equivalent copper conductor, gives the composite cable two special advantages which are sometimes of great importance. First, the corona voltage will be increased, and, secondly, the reactance of the line will be decreased. The corona voltage is nowadays quite frequently the most important factor in fixing the conductor size. For example, a copper conductor of 0.05 sq. in. section cannot be used without corona discharges taking place, even in fine weather, at line pressures over about 70,000 volts; whereas under the same conditions corona discharges will not occur with the equivalent steel-cored aluminium conductor unless the line pressure exceeds 94,000 volts. Thus, with a line voltage of 60,000, the copper conductor would be dangerously near the corona limit, and corona discharges are certain to occur in periods of bad weather, whilst with the aluminium-steel cable the factor of safety against corona loss is much higher.

The inductance of a steel-cored aluminium cable is the same as that of a homogeneous conductor of the same overall diameter, and the presence of the steel core, which carries no appreciable part of the current, has little greater effect on the total reactance than would a core of hemp. The fact that the overall diameter is larger, and that the smaller sag often permits the conductors to be spaced nearer together, results in the total reactive drop in steel-cored aluminium cables being smaller than that in copper cables of the same resistance.

It now remains to explain how the combination of the two different materials into one cable affects the physical characteristics of the cable. It should first be appreciated that under no practical circumstances can there be any relative movement between the steel core and the outer aluminium strands. It is the practice at joints, dead-ends, and anchor points to secure the steel and aluminium separately, so that at these points the two are rigidly fastened together; but, quite apart from this, it is well known that when a stranded cable is under tension the tendency for the outer strands to straighten out causes them to grip the centre strand, or strands, very tightly. In a steel-cored aluminium cable, therefore, the elastic stretch under load must of necessity be the same for both the steel and the aluminium, and it follows that the load will automatically be distributed between the steel and the aluminium in such a way that the stresses are proportional to their moduli of elasticity. The stress in the aluminium will, therefore, be about one third the stress in the steel, and since in a 7-strand cable there will be six aluminium strands to one steel strand, the total load taken by the aluminium will be twice the total load taken by the steel.

Now, supposing the temperature rises, the aluminium will tend to expand more than the steel, but because of the strong gripping action between the aluminium and the steel the actual expansion which occurs will be limited by the fact that it must be accompanied by an extra elastic stretching of the steel. In effect, the result is that the stress in the steel is increased and the load in the aluminium correspondingly reduced. It is desirable to explain that this transfer of load cannot, under practical conditions, continue to such an extent that the steel core is dangerously overloaded, nor can any trouble be experienced with "bird-caging" due to a complete removal of all stress from the aluminium.

The stress distribution between the aluminium and the steel strands is continually changing, but this need cause the designer no concern, because the total tension in the cable, however it may be distributed between the two materials, varies with changes in loading and temperature strictly in accordance with the usual catenary

formulæ. Calculations of sags and tensions under any particular weather conditions can, therefore, be made with the same accuracy as for homogeneous copper or aluminium cables, provided that use is made of certain "virtual" physical constants that are derived from the different physical constants of the two component metals.

No trouble has yet been recorded due to corrosion. The steel core is heavily galvanised, but it is probable that the immunity from corrosion also depends very much upon the fact that the aluminium strands bed so tightly round the core, when under load, that moisture penetration is impossible. The outer aluminium strands are not themselves subject to corrosion unless in alkaline atmospheres. Very many examples are known of thoroughly satisfactory operation of aluminium cables on the sea coast, in the neighbourhood of blast furnaces and other localities where copper is subject to attack. Such troubles as have occurred with aluminium cables can nearly always be traced to the use of copper binding wire, alloy clamps, or some other form of bi-metallic contact exposed to moisture. Bi-metallic contacts are always subject to corrosion in such circumstances, and this point should always be borne in mind.

The jointing of steel-cored aluminium cables requires no very special consideration, except for fairly large sizes. For all sizes up to about ½ in. diameter the standard joint is the McIntyre sleeve as used with plain aluminium cables and sometimes with copper cables, but owing to the much greater strength of steel-cored cables it is usual to use two sleeves twisted in opposite directions, as shown in fig. 5. For larger sizes several methods are available.

That favoured in America is shown in fig. 3. In this case the steel core is first joined by a steel McIntyre sleeve, which is enclosed in an outer cast sleeve of aluminium made in two halves and screwed together. This outer sleeve is bored at the ends to fit closely the aluminium strands, and when the steel joint is made and the outer sleeve screwed up, intimate contact between the aluminium strands and the sleeve is made by squeezing the ends of the latter between the dies of a portable hydraulic press.

In France the "Pairard" joint, illustrated in fig. 4, is greatly used. It has the advantage that no hydraulic press is required, and the joint is shorter and neater in appearance. In this case the aluminium strands are gripped between two wedging cones at the ends of a cast aluminium body. The steel strands are also gripped in a similar way by means of a small cone-type connector which is itself enclosed within the outer aluminium body.

Both the two-piece compression joint and the "Pairard" joint are capable of taking the full tension of the line.

In conclusion, it should be pointed out that steel-cored aluminium cables are not in all circumstances the most economical. Their chief advantage lies in the small sag which is permissible, which makes possible the use of long spans and a reduction in the number of supports. In many cases, such, for example, as distribution systems in towns, the span length is restricted by local conditions, and though in such cases steel-cored aluminium would be cheaper than copper conductors, an even greater economy could be obtained by the use of plain aluminium cables.

In the same way, for heavy low-pressure feeders the extra strength afforded by the presence of a steel core is not necessary. The tension allowable, and hence the sag, is limited by the maximum tension which clamps and insulators can withstand, and in this case also the use of plain aluminium conductors gives the greatest economy.

Briefly, steel-cored aluminium cables are chiefly of value for long-distance transmission, while plain aluminium ones can compete when span lengths are limited by considerations other than economy.

75,000 H.P. NATURAL GAS-FIRED POWER PLANT.

By FRED. A. TALBOT.

Although the State of California is richly endowed with hydraulic resources which are being extensively exploited for the bulk generation of electric energy, the completion of the essential development work occupies considerable time, especially when the hydraulic field lies in a somewhat inaccessible spot rendering rapid survey impracticable, and the establishment of communication facilities, as a preliminary for the haulage of material and labour indispensable. This has been especially noticeable in connection with the San Joaquin Valley. During the past few years the cultivation of raisins and other agricultural produce has advanced at a phenomenally rapid rate, and the necessity to resort to irrigation during the summer season has imposed a difficult task upon those responsible for the provision of cheap power.

Electricity is the pre-eminent form of power for inexpensive irrigation, and the realisation of this fact by the farming industry of California has created a somewhat remarkable situation, which is especially noticeable in the valley of which Fresno is the commercial centre. At the present moment there are approximately 1,500,000 acres of cultivated land in the State dependent upon irrigation by pumping, and as 297 kWh per acre per annum are required, more than 500,000 h.p. is utilised for this purpose during the summer season. The convenience and low figure at which electricity is available has induced the cultivation of the semi-arid land within easy reach of the coast which previously had been ignored, and some idea of the load likely to be imposed in this connection may be gathered from the statement that there are over 3,000,000 acres within easy reach of the seaboard which can be reclaimed for agriculture if only adequate electric energy be available. On the basis now ruling this should offer scope for the consumption of a further 1,000,000 h.p. per year. The hydro-electric corporations appreciate the situation and the significance of the agricultural load, but find it difficult to keep pace with development, for the simple reason that the farmers, cognisant of the possibilities of electric energy, are developing the land in anticipation of the supply being forthcoming, and once the land is taken over the corporations are faced with the necessity to supply energy with all speed to save the crops.

In 1920 the situation in the San Joaquin Valley became critical. The San Joaquin Light and Power Corporation, which is established in this territory, commands an area more than 200 miles in length by 200 miles in width at its broadest point. The total acreage served by the system is 16,584,930, of which 7,916,050 acres are adaptable to agriculture. The total value of all products from the territory served, inclusive of oil, farm produce, live stock, manufactures, lumber, minerals, &c., is in excess of £64,000,000 per annum, with a population of less than 310,000, while the gross revenue of the power corporation mentioned exceeds £850,000 a year. Electricity was introduced to this territory in 1896 by a small company which was the first to transmit the energy over a distance of 36 miles. Reorganisation, combination, and amalgamation have had to be persistently embraced, culminating in the present enterprise, which, up to July 1st, 1921, had spent over £5,250,000 on stations having an aggregate generating capacity of 168,251 h.p. and distribution systems. Yet, notwithstanding the energy displayed, the corporation was faced with a waiting list of 2,000 customers at the termination of the war, which number grew to 4,500 in the course of a few weeks.

To meet the situation the corporation was compelled to hurry forward a hydro-electric plant of 55,000 h.p.,

which was completed within 15 months, and to embark upon a more ambitious scheme which ultimately will yield 407,000 h.p. But owing to the time which the latter undertaking will require to carry through, the corporation was forced to embark upon a comprehensive steam-power plant construction programme. So far as the latter was concerned, the fuel issue did not assume such formidable proportions as is generally the case with such undertakings in California, because the Bakersfield oil fields are in the territory served, and one of the by-products of the oil industry is the natural gas which

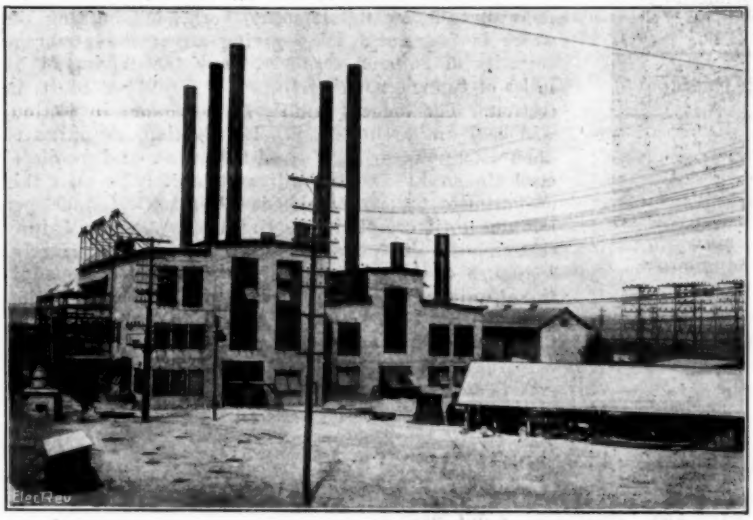


Fig. 1.—Bakersfield 37,500-h.p. Generating Station, California.

is drawn off in enormous quantities. Accordingly the corporation laid down a new 17,500-h.p. steam unit at its Bakersfield station, bringing the output of the latter up to 35,600 h.p., produced by three units, the natural gas for firing the boilers of which is pumped from a point on the oilfields 46 miles distant.

The completion of the new hydro-electric and steam extension provided a further contribution of 72,000 h.p. in the autumn of 1920, and forthwith an extensive "drive" was inaugurated during November of that year to connect up the 4,500 priority customers, the object being to deliver power before the following irrigation season. In the course of six months more than 1,000 miles of transmission and distribution lines were completed, connecting up 50,000 h.p., and the waiting list, then unfilled, demanded an aggregate load exceeding the balance of 22,000 h.p. in hand.

To avoid a power shortage the corporation thereupon assumed the construction of another huge steam-power generating station, the first unit of which was brought into service within eight months of the ground being broken; it would have been available earlier but for the inability to secure delivery of some of the electrical plant. This station, for which 120 acres of land were secured, is at Midway, Buttonwillow, 28 miles from Bakersfield. The power-house, the first part of which measures 140 ft. in length by 128 ft. deep, is of the steel-framed type, housing a battery of eight 622-h.p. water-tube boilers, disposed in batteries of two, designed to generate steam at 250-lb. pressure, superheated to 600 degrees. The first turbine unit of 15,000 h.p. is coupled direct to an Allis Chalmers 12,500-kW generator, and the current, delivered at 11,000 volts, is stepped up to be fed into the new 110,000-volt transmission line extending from Bakersfield to Merced to the north, which is tapped at strategical points *en route*.

The boilers are gas-fired, the fuel being drawn from the Elk Hills oil-fields. The gas is pumped for a distance of nine miles through an 8-in. main at a pressure varying from 450 to 500 lb. per sq. in., which is reduced to about eight ounces at the plant for delivery to the boilers. The consumption of gas averages about 5,000,000 cu. ft. per day. The water supply promised to prove a difficult problem, but this was satisfactorily met by six wells sunk to depths ranging from 350 to 585 ft. The wells are lined with a 12-in. casing and have a total delivery of 4,000 gallons (American) per minute. Tests proved the water to be of great purity and suitable for boiler-feed purposes, so that a treating plant has not been found necessary.

The boilers have a total evaporating capacity of about 180,000 lb. or 22,500 gallons per minute, and practically the whole of the water evaporated into steam, after passage through the turbines, is led through condensers for return to the boilers. Steam from the main turbine is condensed by a surface condenser having 30,000 sq. ft. of cooling surface. It comprises 6,000 1-in. brass tubes, 20 ft. long, through which the condensing water is circulated. A supply of 24,000 gallons of water per minute is required for circulation purposes, and this is furnished through a 30-in. centrifugal pump driven by a 150-h.p. steam turbine.

The water enters the condenser at about 80 degrees and leaves at 90 to 95 degrees. It is cooled in a spray pond measuring 300 by 200 ft. and 4 ft. in depth, being projected 6 to 8 ft. into the air through 360 brass nozzles, and in this manner has its temperature reduced to from 5 to 10 degrees below that of the atmosphere. This spray pond is also designed to serve as a water supply reservoir in case of fire. Water for domestic use by the employés is supplied from a second tank of 20,000 gallons elevated 50 ft.

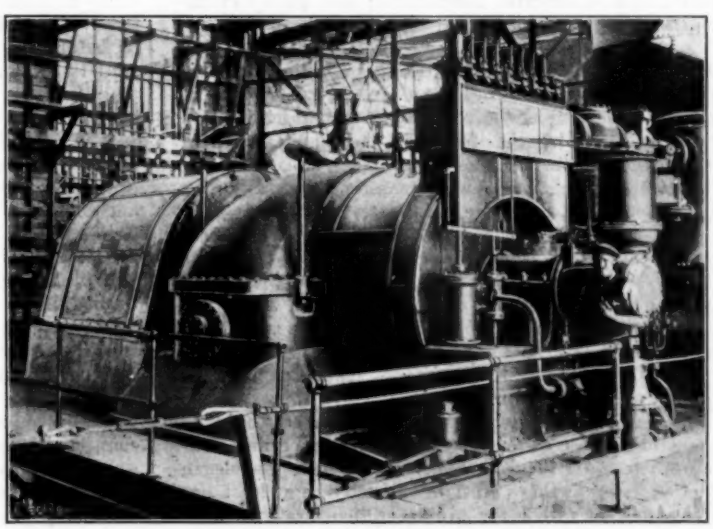


Fig. 2.—A 12,500-kW Turbo-Generator at Midway Station, Buttonwillow.

When the Midway station is completed it will house four units similar to that already installed, the de-

signed rated capacity being 75,000 h.p. The station has a frontage on two main streets, and on the site there has also been erected fourteen five-roomed permanent

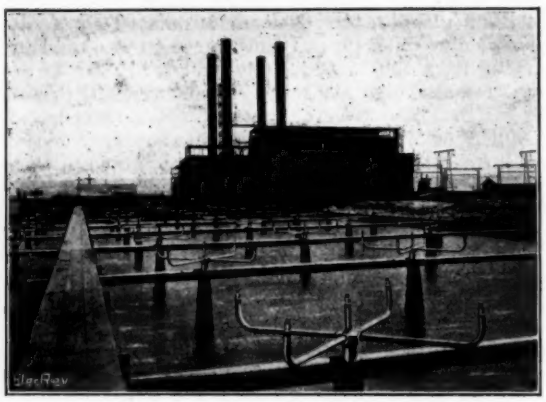


Fig. 3.—Spray Cooling Pond at Midway Station.

cottages for the employés. These houses are equipped with all modern domestic conveniences, including natural gas heating appliances and electric lighting. The completion of the initial part of this plant, costing £500,000, permitted the pressing demand for power to be relieved, but the crisis was not effectively avoided until two months later by the completion of the Kern River hydro electric station, which increased the aggregate available energy to 181,900 h.p. The larger scheme on the Kings River, 50 miles east of Fresno, which will furnish 407,000 h.p. through nine power-houses ranging in capacity from 4,270 to 162,615 h.p., and working under effective heads of 122 to 2,385 ft., is now in hand. The realisation of this scheme will take some years, since it involves heavy development work, impounding the water in four large lakes giving an available storage capacity of 269,400 acre-feet, and the driving of 34 miles of tunnels ranging from 6 x 6 to 14 x 14 ft. in section. The longest tunnel, 12 ft. square in section, will be 7½ miles in length. In addition, six miles of open ditch, two miles of woodstave pipe, and ½-mile of steel siphon have to be built and laid. To meet this commitment the corporation is allocating £400,000 per annum until completion. Extensions to the Midway steam plant can be carried out somewhat more leisurely, inasmuch as the relative rapidity with which the additional units can be installed will enable the corporation to anticipate safely any sudden demand that may be likely to arise.

STEAMPIPE ARRANGEMENTS.

By EDWARD INGHAM, A.M.I.Mech.E.

In designing a steam plant, the arrangement of the pipes conveying the steam from boilers to engines is a matter of vital importance, particularly where the pipe ranges are of great length. Nevertheless, this question is commonly regarded more or less indifferently, and to this attitude must be attributed a large proportion of the steam pipe failures which occur from time to time.

In designing a range of steam pipes, it is well to bear in mind that pipe explosions are brought about in three principal ways: (1) By water hammer action; (2) by expansive and contractive movements; and (3) by vibration.

Water Hammer.—Water hammer is the action which takes place when volumes of water are propelled violently along the pipes until they meet an obstructing metal wall, as, for example, the bend of a pipe, which is more or less strained by the force of the impact, and in severe cases, fractured.

Since the formation of water cannot be avoided, the object should be to arrange the pipes, as far as practicable, so that no water can settle at any part. The ideal arrangement would be that in which there were no parts in which water could collect, *i.e.*, one straight length of piping almost horizontal, except for a very slight fall from boilers to engines. With such an arrangement, all water would drain naturally towards the engines, where it could be collected in a suitable separator or drop leg, and run off from time to time.

Under such circumstances, water hammer would be impossible, so far as the steam pipes are concerned. Unfortunately, this ideal arrangement is not possible in practice, because there must of necessity be at least one vertical rise or fall in the piping, which means in most cases that "collecting lengths" or pockets are found in the range. Nevertheless, in a great many instances, there are more of these pockets than need be, and it seems obvious that many pipe designers have paid no attention to the question of avoiding them.

A case in point is frequently seen on the boiler itself, where the steam, after passing through the junction valve, is made to rise up a short vertical length to the main steam pipe. Clearly, when the junction valve is shut, water of condensation will gradually collect in the vertical length above the valve. This objection is easily obviated by placing the junction valve on the top of a short stand pipe, so that it is level with the main range, instead of direct on the mounting block on the boiler.

With the object of preventing danger from water hammer in all cases where water chambers cannot be avoided, two precautions should be taken—one by the designer of the pipes, and the other by the person in charge of the steam plant. The first is to provide efficient drains at every point where there is any possibility of water accumulating; the second is to make certain that all the drains are opened and the water run off before the steam is turned into the pipes. It is most important that the drains should be of ample area, and that they should not be allowed to get choked or partially choked with deposit.

It is advisable to connect up all the drains to a good automatic steam trap. An attendant is always liable to forget to open the drains before turning on the steam, and should any considerable quantity of water have collected, risk of water hammer is incurred. A steam trap, provide it be maintained in reliable working order, will drain off all water of condensation as fast as it is formed.

When there is no steam trap, the engineer-in-charge should not attempt to drain off any water under pressure. Under certain conditions, to do this is really dangerous.

Suppose, for example, a vertical length of piping is connected with a horizontal length below, and that water has filled the latter and part of the former length. Now if the drain tap be opened, the water level in the vertical pipe will fall steadily, and no serious consequences are as yet liable to ensue. When, however, the level falls to that of the horizontal length, a long surface of water is exposed to the steam. Since the water is at a lower temperature than the steam, heat flows from the steam to the water, in consequence of which, some of the steam condenses, and a partial vacuum is formed. The action now would appear to be as follows:—The steam rushing into the horizontal length agitates the water contained therein, giving to it a wave motion. The water is driven forward with great violence, and

although the pipes may be strong enough to resist many times the normal working pressure, they may be much too weak to resist the excessive stresses set up when the water meets the first obstructing metal surface. It is in this way that fracture and explosion of steam pipes may occur.

In a recent explosion, the engineer-in-charge opened the drain cock to run off water from a vertical length before opening the junction valve. The drain, however, was partially choked, and the junction valve was opened before all the water had been run off.

All that happened for a time was a little crackling in the pipes whilst the vertical length was being drained, but when the water level had fallen to that of a long horizontal pipe connected with the vertical pipe, water hammer action was set up, and the pipes exploded. This accident shows the importance of arranging, as far as possible, that the outlets of the drain cocks should be visible.

As a further precaution against water hammer, steam should always be turned on very gradually. It stands to reason that if the conditions for water hammer exist, there is far more risk of danger if a full body of steam is admitted suddenly into the pipes, than if the flow is made very gradual.

Expansive Movements.—Next in importance to water hammer as a cause of explosion of steam pipes is the question of expansive movements of the pipes. The forces set up during expansion are practically irresistible, and unless this fact is recognised by the designer, fracture will be likely to result.

There are several ways of allowing for expansion of steam pipes. If the range is not a long one, the expansion of a certain length of piping can be suitably taken up by another length running at right angles to the first. If those concerned in the design of steam pipes would take a little trouble in sketching out two or three arrangements instead of adopting the first which presents itself to their minds, rigid pipe arrangements would be much less common than they actually are.

When considerable expansion is to be allowed for, it becomes necessary to provide special spring bends, expansion cushions or joints of some form.

The most scientific arrangement from the theoretical point of view is undoubtedly what is known as the gland expansion joint, in which the end of one pipe is supposed to slide freely into the end of another as expansion takes place, a gland and packing being provided to prevent leakage of steam. But expansion gland joints are frequently found defective, and as they often give trouble from leakage of steam, and are expensive to make, most pipe designers prefer other means of taking up the expansion.

Expansion bends are of various forms, but most of them approximate to the form of a horse-shoe or a complete loop. When made with a large sweep, they are capable of taking up considerable expansive movements without undue straining. They are mostly made of mild steel.

As far as possible, expansion bends should be arranged so that they do not form chambers in which water of condensation can collect. Otherwise, they must be provided with suitable draining facilities.

Other devices for taking up expansive movements are somewhat loosely classified as expansion diaphragms, cushions and bellows joints.

All these essentially consist of copper or steel plates of curved or dome form, fixed between two flanges, and the whole piece is inserted between the flanges of the two pipes adjoining each other. The expansion is taken up by the yielding of the curved plates, the action being very similar to that which takes place in a concertina or a bellows.

Whatever sort of expansion device is adopted, particular care must be taken to fix the device in the right place. In general, the expansion piece should be arranged centrally, and the ends of the pipe length whose expansion is to be accommodated should be anchored. Only in this way can it be ensured that each device will satisfactorily fulfil the purpose for which it is intended.

Vibration.—Vibration of steam pipes can scarcely be regarded as a common trouble, but it is occasionally experienced, and under certain conditions proves to be a most serious and even dangerous annoyance. The general effect of vibration in steam pipes is to cause more or less severe stresses in the pipe material, and in course of time these stresses, oft repeated, cause fatigue and weakening of the material, which is then liable to fail under the steam pressure.

With regard to vibrations caused by pulsations of the steam, it has to be remembered that the flow of steam along the pipes is not steady, but is in the nature of a series of waves, due to the fact that a piston engine does not take the steam continuously, but only periodically, when the admission valves open.

These pulsations of the steam are, of course, transmitted to the pipes, which are made to vibrate in consequence. In the majority of cases, the vibration is so slight as to be inappreciable, but occasionally it becomes annoying. The trouble is most liable to occur if the pipes are of small diameter; when they are amply large, the flow of steam is comparatively slow, and there is not the same tendency for the trouble to be set up.

When the vibration is due to pulsations of the engine, the trouble is likely to be more pronounced than in the other case. In general, two conditions must be fulfilled before an engine can set the steam pipes vibrating. The first condition is that the engine is not properly balanced, and the second that the natural period of vibration of the pipes just synchronises with the period of vibration of the engine.

Obviously, when the trouble in question occurs, a slight alteration of the speed of the engine will often entirely prevent the trouble. Even when the vibration is due to steam pulsations, an alteration of speed of the required amount may for similar reasons be expected to relieve the trouble.

The supports used for carrying the piping will have an influence on the natural period of vibration of the pipes, and hence, by altering or replacing the supports so that the natural period no longer coincides with the period of pulsation, the trouble may be overcome.

Pipe Material.—It will be obvious from what has been said that steam pipes have to resist stresses in addition to those due to the steam pressure, some of which may be very severe, and for this reason the question of material is an important one. To reduce the risk of failure to a minimum, the material used should possess the qualities of tenacity and ductility in a high degree.

Mild steel ought to be used in almost every case, in preference to any other material. There can be no question that if it were universally adopted, steam-pipe explosions would become much less frequent than they are at the present time.

A New Traffic Light.—Various systems of traffic or signal lights have been installed in the U.S.A. during recent years in order to care for the ever-increasing traffic on city streets at night. They have consisted of elevated beacons which are also used to control the traffic; iron, wooden and concrete posts equipped with illuminated globes at their tops; illuminated signs, &c. A recent development in a traffic signal that is discernible by day and by night is the Mushroom light, first used in Milwaukee, and since in many other cities, including Chicago, Cleveland, Minneapolis, Indianapolis, Detroit, St. Louis, Kansas City and many smaller cities. This new light consists of an 18-in. heavy ruby glass hemisphere covered with a ribbed steel grating rising 8 in. above the pavement. Its hemispherical shape causes the wheels of passing vehicles accidentally striking it to slide off easily without injury either to the light or to the vehicle. In this type of unit there is no part to be broken off by impact; two 75-watt lamps are used. This light is designed primarily for use in the centre of street intersections, especially at intersections where traffic is heavy, but where a policeman is not regularly stationed. Its presence in the street ahead immediately denotes to the motorist a busy corner. By dividing the traffic and keeping motorists on the proper side of the thoroughfare, the possibility of accidents is greatly reduced.— A.I.E.E. *Journal.*

LEAVES FROM AN INSPECTOR'S NOTEBOOK.

By "ANODE."

A point to which sufficient importance is not paid by users of electrical machinery is that of duplication, and if this were more often considered when installing additional machines, or replacing old ones, a deal of trouble and manufacturing losses would be saved.

In the course of my travels I have dropped across numerous cases where it would have been possible by a slight additional expenditure to duplicate an important or key machine, yet the opportunity had been neglected, with the result that on a breakdown of the key machine, the whole of the works had perforce to stop, whereas, had a duplicate been available, it could have been installed in the place of the faulty machine, and the probable result would have been that the output of the works would not have been seriously affected.

An instance of this occurred some years ago, in a small foundry, where the key machine was a 30-h.p. motor driving the blower. No other motor in the place was of anything like the power, and the firm did not feel like going to the expense of buying a duplicate, which probably would have remained idle for a lengthy period.

I urged upon the owners the advisability of making some arrangement to ensure that in the event of a breakdown they could carry on, but without avail, until one day, when I was making my customary inspection, they asked my advice as to purchasing a motor for an extension of their works.

The maximum horse-power required would be 20, and that very seldom, and their idea was to install a 15 or 16-h.p. motor conservatively rated, and rely upon its overload capacity for the exceptional instances when the 20 h.p. would be required.

The opportunity was too good to be missed, and I put forward the suggestion that it would be advisable to duplicate the blower motor; even though it would cost more than the 16-h.p. machine, it would consume very little more energy, and in the event of a breakdown of the blower, they would not have to close their works for any lengthy period, as two hours would suffice to change-over the machines.

After a lot of discussion they decided to do this, and having gained my point, I went a step further and suggested that they should also duplicate the starting switch, which was arranged for speeds above and below normal. This was also agreed to, and the necessary particulars, together with the order, were duly dispatched to the motor manufacturers. The firm was then in the position that in the event of a breakdown of either the motor or the starter, it could get going again immediately, and further that the motor working in the new extension would be running on an easy load, and capable of dealing with the occasional 25 per cent. extra load without difficulty, and still leave a reserve of power available if any extra were required.

A few months later, at a time when they were exceptionally busy, the blower motor completely burnt out, necessitating rewinding of both armature and fields, and the change-over to the duplicate was made; it was found that the total loss of output was 15 per cent., whereas had this duplicate not been available, it would have taken as long to obtain another machine as to rewind the burnt-out one, and for that period the whole of the output would have been lost. This afforded a striking example of the value of even a partial duplication, and there are many instances where something on similar lines could be arranged.

It is not always the case that the largest machine in a works requires duplicating, as the following instance will show:—

A large works had an electrical installation second to none in the kingdom; all the machines were standardised and so arranged that practically any motor could be replaced at once, and in addition they had at least 50 per cent. of the armatures duplicated, so that it appeared impossible for any breakdown to cause more than a very brief stoppage.

On going round these works I was greatly impressed with the admirable arrangements of the whole installation, yet there was a cockroach in the jam.

The generating plant consisted of two large high-speed sets, one of which worked at a time, and of ample capacity for the whole requirements of the works, yet only one condenser pump motor was installed for both sets, and this was the only motor that was not duplicated, no motor of the same size and speed being available in the works.

In the event of this motor breaking down, the position would have been very awkward, and on my pointing this out to the managing director he was greatly surprised, and immediately put a spare machine on order.

It would certainly have been possible to work the sets non-condensing, but the loss would have far outweighed the cost of the small motor.

It is not always so easy to advise clients as in the two instances related, as in some cases where firms adopt a penny-wise policy, one finds an installation of perhaps 60 motors representing a dozen different makers and all of different powers and speeds.

One happy-go-lucky firm of this sort on one occasion had a breakdown to a 25-h.p. machine, and was forced to substitute a 15-h.p. motor, this being the only one available near the speed required, and to work on half the plant for a week or two, a serious matter during the war, and still more serious from the point of view of munition supplies.

This taught the owners a lesson, and when they extended their works, the electrical portion received very careful attention, the new plant being so arranged that not only was it standardised, but it duplicated a fair portion of the older plant as well.

It is not only the motor that requires duplicating; it should always be possible to replace a defective starter, and it is common knowledge that there are some thousands of these to be found all over the country.

I suppose the history of the motor-starting switch is something like this: When the first man made a motor he found that it was not lucky to start it by closing the main switch, especially when the motor was of any size, so he made a graduated resistance which went in series with the motor, and gradually evolved something on the lines of a multiple switch, which took the place of the old main switch as the starting device.

This went on till one day the generating station broke down and the motor stopped, the resistance, of course, being cut out. The generating station got going, and the poor motor got the lot suddenly, with disastrous results.

Then the brainy man designed a no-volt release, which acted sometimes, and more often did not.

The next thing was that the motor got overloaded, so he set to work and designed the overload release, that beastly little thing made out of hairpins and odd brass strip, which acted, or was supposed to act, by short-circuiting the no-volt coil.

After thirty years we find the same device stuck in the south-west corner of the starter, and still as profanity-provoking as it was in the beginning.

Then the cheap-jack took a hand in the deal, and cut down everything to the finest limits, and turned them out by the thousand, and at such a price that when you bought a motor, a starter was thrown in like overweight margarine, and 75 per cent. of the motors running to-day are controlled (?) by these rotten cheap starters, with the result that 50 per cent. of the motor breakdowns are directly caused by them.

It is to the credit of a few firms that this state of affairs is being altered, and they have succeeded in turning out absolutely reliable control gear, and I find that the leading engineers are paying great attention to this question of control, in many cases the control gear costing more than the motors it works in conjunction with.

THE EFFECT OF HEAT ON THE ELECTRIC STRENGTH OF SOME COMMERCIAL INSULATING MATERIALS.*

By W. S. FLIGHT, A.M.I.E.E.

It is chiefly to the insulating materials used that we shall have to look for future improvements in electrical machinery, and in this connection a knowledge of the effect of heat upon the electrical and mechanical characteristics of insulating materials is of the greatest practical importance.

Following upon his "Tests on Insulating Materials,"† and his experiments on the "Dielectric Strength of Solid Insulating Materials,"‡ the author conducted an investigation in the Research Laboratories of the Metropolitan-Vickers Electrical Co., Ltd., to ascertain the variation in electric strength between temperatures of 30 and 100 deg. C. of many of the solid insulating materials at present employed in the manufacture of electrical machinery and apparatus.

The most important factors to be considered to enable the test conditions to be standardised so that the effect of variation of temperature can be studied, are explained in the original paper, throughout which the "electric strength" is expressed as volts per mil. By that term is implied the voltage required to break down unit thickness of the material.

Temperature voltage curves were obtained for each material, dry and humidified specimens being tested in dry and damp air and in oil.

Papers.—It would appear that the following facts can be deduced:—

(*a*) When damp papers are tested in air the electric strength at 100 deg. C. may be higher than that when tested cold, due to evaporation of some of the moisture, which takes place even when the paper is surrounded by damp air.

(*b*) When damp papers are tested in oil the electric strength at 100 deg. C. may be higher or lower than that when tested cold. This depends on whether the voltage is raised sufficiently slowly to permit of the moisture being driven out through the oil. Under the conditions in which the insulation is placed in, say, an oil-immersed transformer, and when the voltage is raised at the usual rate for the high-pressure test, it would appear that the electric strength of damp paper when hot would certainly be lower than that of the same material when tested cold.

(*c*) When dry papers are tested in air or in oil the electric strength at 100 deg. C. would appear always to be lower than when cold, particularly in the case of tests in oil.

Micarta.—All the results on this substance were obtained on materials composed solely of paper and varnish, and as it is largely employed for the insulation of oil-immersed apparatus, the majority of the tests were conducted in oil. The decrease in breakdown voltage with increase in temperature is very rapid. Speaking generally, it would appear that the synthetic bonds have a higher electric strength than the natural-gum bonds at 100 deg. C., probably partly due to the fact that at this temperature the synthetic-gum micartas retain most of their initial mechanical strength, whilst the natural gum micartas were all found to be extremely soft and flexible.

The average of all the tests on all bonds and papers investigated clearly shows that whilst the addition of the bond to the paper makes the electric strength of micarta at 30 deg. C. higher than that of the same thickness of unvarnished paper, the reverse is the case when the materials are tested at 100 deg. C. At first sight this is very surprising, but both natural and synthetic gums are extremely complex chemical mixtures; when either of these types of gums is heated destructive distillation takes place. Some of the constituents given off consist of organic acids, and water is also often one of the distillates. Even at 80 deg. C. certain gums give off small quantities of highly acid distillates, whilst at 100 deg. C. practically all the gums which have been employed for the manufacture of micarta produce acid distillates. Even if the quantity produced is extremely small its acid nature and the fact that it is evolved inside the insulation may conceivably result in a very appreciable decrease in electric strength. To those acid distillates is attributed the rapid decrease in electric strength.

The materials and process for the manufacture of micarta offer a most profitable field for further research, and even with the bonds at present employed much can be done by suitable heat treatment to remove the acid distillates and so raise the electric strength at 100 deg. C.

Fullerboard.—By this term is meant a good quality paper board known as fullerboard, pressboard, or press-spahn.

The electric strength of a material of the nature of fullerboard may vary over a very wide range, depending on the treatment it has received and the condition of the sample at the time of test. Thus, when untreated, fullerboard of a thickness of 1/16 in., which had previously been exposed to a damp atmosphere, was tested in oil, the electric strength at 30 deg. C. was of the order of 110 volts per mil only. If the same material is dried and impregnated with a mineral oil, the electric strength at 30 deg. C. when tested under the same conditions may be as high as 1,000 volts per mil. The corresponding values when the samples are tested in oil at 100 C. are 48 and 610 respectively. These facts are of the utmost importance in the manufacture of electrical machinery, particularly when the thickness of the insulation used is such as to impose, during the high-voltage pressure-test, stresses near the breakdown voltage of the dielectric. It is quite conceivable that apparatus which, with correct treatment, might have had an ample factor of safety on the test voltage, may not, as the result of incorrect treatment, be able to withstand the test voltage.

When using a material of the nature of fullerboard, the electric strength depends even more on the thoroughness of the treatment than upon the initial electric strength of the material previous to treatment. On the whole, fullerboard would appear to be a more suitable material for high temperatures than micarta, and it has approximately the same electric strength at 100 deg. C. as thin papers. At lower temperatures the effect of the treatment given to fullerboard is more pronounced, resulting at 30 deg. C. in the electric strength being about the same as that of micarta and higher than that of untreated papers.

Varnished Cloth.—When this material is tested cold it compares very favourably with the others already considered, but when tested at 100 deg. C. it is no better electrically than paper of fullerboard, though superior to micarta.

Mica Products.—Nine materials were investigated: *i.e.*, mica cambric (untreated cambric, overlapping mica splittings, and Japanese paper); flexible mica paper (untreated paper, overlapping mica splittings, and Japanese paper); mica varnished cloth (yellow varnished cloth, overlapping mica splittings, and Japanese paper); micafolium plate (overlapping mica splittings, shellac varnish, and paper); mica silk (silk, overlapping mica splittings, and Japanese paper); hard mica paper (mica splittings, shellac, and paper); mica Japanese paper (overlapping mica splittings, Japanese paper, and flexible sticking varnish); flexible micanite (overlapping mica splittings and flexible sticking varnish); and hard micanite plate (overlapping mica splittings and shellac varnish, steam heated and pressed).

In all the mica products there is less decrease in the elec-

Average Breakdown Voltage of $\frac{1}{16}$-in. Thickness of Insulating Materials.

Material.	Average of air tests, B.D.V.			Average of oil tests, B.D.V.			Average of all tests, B.D.V.		
	At 30° C.	At 100° C.	Increase or Decrease.	At 30° C.	At 100 C°.	Decrease.	At 30° C.	At 100° C.	Decrease.
	kV.	kV.	Per cent.	kV.	kV.	Per cent.	kV.	kV.	Per cent.
Papers	12·0	13·7	+ 14	32·2	23·5	− 27	22·2	18·5	− 16·5
Micarta	27·9	7·7	− 75	28·8	11·8	− 61	26·2	10·8	− 59
Fullerboard	18·0	16·8	− 6·7	27	17·5	− 35	26·7	18·6	− 30
Varnished cloth...	27·8	16 2	− 41·6	30·7	23·1	− 24·6	28·1	17·1	− 39
Mica products	29·3	31·0	+ 5·8	35	30	− 14·4	32·3	30·5	− 5·6
Varnished paper	24·8	17·2	− 30·6	38·5	17·7	− 54	31·7	17·4	− 45·5
Varnished asbestos paper ...	7·3 (H)	1·2 (H)	− 84	15·0 (D)	8·4 (D)	− 44	11·2	4·8	− 57
Fibre	7·5 (H)	1·5 (H)	− 80	25 (D)	7·5 (D)	− 70	16·0	4·5	− 72
Treated wood	—	—	—	17 (oil)	11·3 (oil)	− 33·5	17 (oil)	11·3 (oil)	− 33·5 (oil)
Moulded composition, No. 1 ...	5·0	2·6	− 48	9·0	2·0	− 78	7·0	2·3	− 67

D = dried; H = humidified.

*I.E.E. *Journal*, Feb., 1922; p. 218 (abstract).
†Elec. Rev., Dec. 9th, 1921; p. 771.
‡Elec. Rev., Jan. 13th, 1922; p. 39.

tric strength at high temperatures than in the case of fibrous materials. With some of the materials, however, there is still an appreciable decrease, particularly when tested in oil (when they could not readily get rid of any moisture or varnish compounds which they contained). In this connection it should be remarked that very few of the above-named mica products are actually employed for the manufacture of oil-immersed apparatus. When tested in air the small samples evaporated some of the volatile constituents contained in the backing materials or the bonds. When the above-named mica insulations are employed in electrical machines they are usually wrapped layer upon layer and so confined that they cannot readily evaporate any volatile matter; consequently, the tests in oil afford a truer indication of the behaviour of the materials in service than do tests in air. This opinion was confirmed by test on high-voltage stator bars insulated with micafolium. As the percentage decrease in this case is considerably more than even that found in the oil tests on micafolium, it tends to show that in the case of very heavily insulated bars the volatile matter driven off from the shellac may very appreciably lower the breakdown voltage of the bars. Fortunately, as is the case with micarta, it is possible by suitable heat treatment during the manufacture of the coils to remove a large percentage of the volatile constituents and thus to appreciably increase the hot breakdown voltage of machines insulated with mica products.

Miscellaneous Materials.—In the case of varnished paper, varnished asbestos paper, fibre, treated wood, and moulded compositions, results were obtained up to a temperature of 140 deg. C.; they thus give a little information with regard to the hitherto unexplored region beyond 100 deg. C.

Deductions.—In order that the large mass of information contained in the paper may be more easily reviewed, the average figures for each class of material tested have been collected together in the accompanying table, and the percentage decrease in breakdown voltages for a rise of temperature of from 30 to 100 deg. C. has been calculated on the breakdown voltage at 30 deg. C. Although in a few cases of tests in air a small increase is obtained when breakdowns occur at 100 deg. C., in the majority of cases there is a very decided drop in the breakdown voltages, the values of which may be reduced to 50 per cent. of those obtained at 30 deg. C. Mica products suffer the least loss of electric strength, whilst with micarta, varnished asbestos paper, fibre, and certain moulded compositions the decrease is the greatest.

This investigation has clearly shown that the electric strength of most of the solid insulating materials at present in use decreases with increase in temperature up to 100 deg. C. As in modern machines hot-spot temperatures as high as, or even higher than, this may occur at periods of overloads, it is of the utmost importance that the electric strength of the insulating materials should be determined at 100 deg. C. and not at the temperature of the air, as has usually been done in the past. There is a very great need for systematic research work with a view to increasing still further our knowledge of the electrical characteristics of commercial insulating materials at temperatures likely to be attained in electrical machinery, and to developing new materials which will be more capable of withstanding these temperatures than the materials now employed.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Sand-Cooled Starters for Three-Phase Motors.

During and since the war it has been difficult to obtain oil in Germany for electrical apparatus, and various attempts have, therefore, been made to employ substitutes for cooling purposes. Water has been used with some success for cooling three-phase motor starters, a layer of oil preventing evaporation. The permissible loading of the resistance elements is, however, strictly limited when water is employed. This and other disadvantages are avoided by the use of sand as a cooling medium. Sand is, of course, inapplicable to transformers, switches, and other gear in which the cooling medium must serve also as insulation; neither is it applicable where there are submerged moving contacts. As a means of cooling the resistances of motor starters, however, it offers the advantage that the starter can be dispatched by the maker ready for immediate service.

The sand-filled rotor starter shown in the accompanying illustration (fig. 1) is made by Brown, Boveri & Co., for use with three-phase motors. The construction is simple and inexpensive, and the starter is quite suitable for use by unskilled persons. The elimination of fire risk is an important consideration, and starters of this type are applicable in many cases where air-cooled starters have hitherto been used. The resistance spirals R are carried by insulating ferrules A in the plates B C, and connected to contacts F in the plate D. The star contact-arm G is operated by the lever L, the switch contacts and arm being enclosed by a casing H as a protection against dirt and accidental contact. The sand-filling reaches, as shown, to the under-side of the contact plate, and cables K

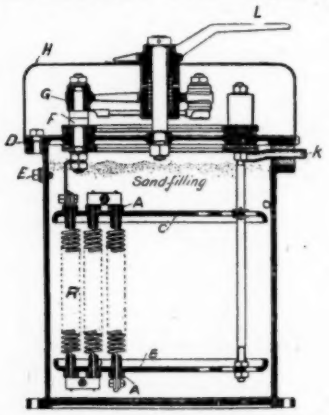


Fig. 1.—A Sand-cooled Motor Starter.

are fitted permanently, for connection to the rotor terminal board. No "off" contact is provided, hence the rotor circuit cannot be opened. Slow-motion operating gear is easily fitted if required.—*E.T.Z.*

The "Wefco" Gas-proof Hand Lamp.

A patent gas-proof safety electric hand lamp has recently been placed on the market by Messrs. Watts, Fincham and Co., Ltd., 22, Billiter Street, E.C.3. This, known as the "Wefco" lamp, is illustrated in fig. 2. The outer case is of

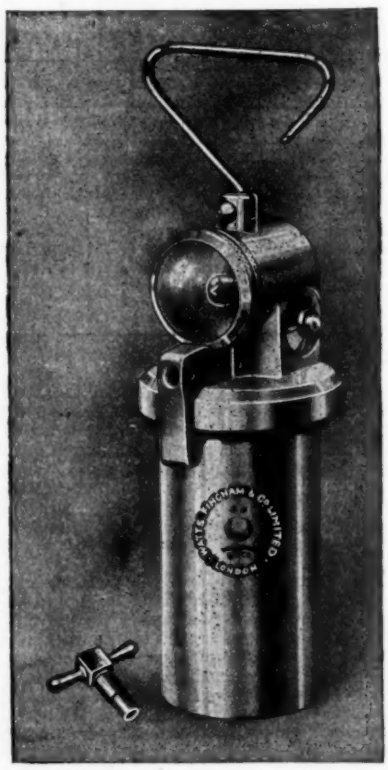


Fig. 2.—The "Wefco" Gas-Proof Hand Lamp.

an aluminium alloy, and is fitted with a patent locking device operated by a triangular key, without which the lamp cannot be opened. The accumulator is of the alkaline type, and is "unspillable." The switch and contacts are self-contained, the former being operated by "on" and "off" push buttons. The total weight of the lamp is 5½ lb. The lamp is dismantled by unscrewing the lock to the full extent of the locking screw by means of the key. The base is removed by unscrewing it from the top. The switch and contacts are removed by unscrewing the lamp bulb, and taking out a rubber joint ring, when the part will slip out as a whole. The lamp will give a continuous light for ten hours, and has been approved by the Mines Department, the Board of Trade, Lloyd's, and leading petroleum companies for use on tank steamers.

LEGAL.

British Thomson-Houston Co., Ltd., *v.* N.L.O. Co.

In the Vacation Court on August 9th, the Lord Chief Justice had before him two motions by the plaintiffs against the N.L.O. Co., for injunctions restraining infringements of letters patent.

Mr. Whitehead, for the plaintiff company, in moving the first motion stated that a certificate of validity of the patent had been granted. The defendants had posted back to the plaintiffs the writ and notice of motion served upon them, and had not entered an appearance.

His Lordship granted the injunction asked for.

Mr. Whitehead said that the second motion dealt with a different patent.

Here again there was no appearance on behalf of the defendants, and an injunction in this case was also granted.

Electricity in Mines.—Coal-Cutting Machine Accident.

Sheriff Principal A. O. M. MacKenzie, Glasgow, has reversed the decision of his substitute in a test action arising out of a fatal explosion at Auchengeich Colliery, Chryston, when two men who were operating a coal-cutting machine were killed and four brushers severely injured. Actions were raised in the case of the deceased and injured men against the colliery owners, Messrs. James Nimmo & Co., Ltd., but five of these have been sisted pending a final decision in the present case (George Connell *v.* Nimmo & Co.). The Sheriff Substitute, in the first instance, assoilzied the company from all the conclusions of the action. The Sheriff Principal, on the other hand, finds the defenders liable to the pursuer in damages under the Employers' Liability Act, but not at common law, and assesses the damage at £325, with expenses. His Lordship finds that the explosion was caused by the ignition of gas caused by a spark from an electric coal-cutting machine fitted with a switch box cover which the men operating the machine had negligently failed to screw down properly. He also finds that the fireman employed by the defenders to inspect the section on the pursuer's shift negligently and without sufficient excuse failed to inspect the section as required by the Coal Mines Act within five hours of the previous inspection.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

A Breach of Confidence.

The Dundee Corporation has long since earned the reputation of not being "quite the thing," and that it seems determined to live up to their odious repuation will be apparent to everyone who learns of its bad faith in connection with the applications for the post of city electrical engineer.

Its latest achievement is to publish broadcast in the Scottish Press a full and complete list of all applicants, their addresses, ages, and qualifications.

Their disreputable measure has caused consternation amongst many who had made application in confidence, and there have been many unpleasant sequels resulting from this gross breach of faith.

To those candidates who were hopeful of getting the appointment this exhibition of bad faith should serve as an unpleasant reminder of the kind of body they would have to serve under.

Such conduct gives honourable men a feeling of nausea.

John Ogilvie.

Dunfermline, *August 15th*, 1922.

[The action of the Corporation was, in our opinion, most regrettable.—Eds. Elec. Rev.]

Electrical Supplies in South America.

In your issue of June 9th, page 819, there appears an article on "Electrical Supplies in South America," by Mr. Percy F. Martin, which I read with a good deal of interest.

I should like, however, to correct the remarks which concern the city of Rosario de Santa Fé (Argentine).

The Sociedad de Electricidad de Rosario is a Belgian concern and one of the many controlled by the Société Financière de Transports et d'Entreprises Industrielles, Brussels. The power house has 28,000 kW of plant installed, and last year generated over 35,000,000 kWh. There are roughly 2,100 motors installed, with an aggregate h.p. of 17,500; they range from 250 h.p. down to the smallest used for such purposes as coffee grinding, &c.

The centre part of the city is fed with direct current at 2 x 220 volts, all motors over 5 h.p. being connected across the outers. The other parts of the town are supplied by 3-phase alternating current, 220 volts, 50 periods. There is no 110-volt supply in Rosario.

The tariff, according to the municipal concession, is as follows:—

Private Houses.—First 30 kWh per month per kW installed $0.15 gold; rest at $0.095 gold.

Business Houses.—$0.17 gold per kWh.

Motive Power.—First 30 kWh per month per h.p. $0.08 gold. Rest up to 1,000 kWh $0.06 gold. All above at $0.045 gold.

In the case of power users, special tariffs are given depending upon load factor, consumption, &c. A large number of our power consumers are supplied on the maximum demand principle, a fixed charge being made per kW year in addition to a low-priced energy charge. Large consumers' agreements usually contain a combustible clause, the price per kWh rising and falling in proportion to the price of fuel.

Motors are hired or sold on the hire-purchase system.

The Sociedad de Electricidad de Rosario, in addition to being the sole supplier of electrical energy in Rosario, also supplies energy to the municipality for public lighting, and to the Compañia General de Tranvias Elétricos de Rosario, a Belgian concern.

The principal fuel used is petroleum (fuel oil) a large portion of which is obtained from the Argentine fields of Comodoro Rivadavia.

In conclusion, I would say that the British Chamber of Commerce, Buenos Aires, has a permanent Electrical Committee, and I am sure would be pleased to give the fullest information possible regarding the electrical market in the Argentine.

Sociedad de Electricidad de Rosario,
L. W. Migotti,
Technical Director.

Rosario, *July 14th*, 1922.

Small Private Generating Stations.

The letter from the Secretary of the Electricity Commission on the above subject in your issue of the 11th inst., is but another instance of the usefulness (*sic*) of bureaucracy. The article "Small Generating Stations" would surely be deemed under ordinary conditions to be a useful reminder or suggestion to the trade of a way to lessen unemployment and boost up trade. But no, our bureaucrats step in and so our unemployed must still draw the dole. But need they?

No, sir, and I say it with good reason; let the contractor carry on, the Commissioners will not stop him. They may inform the contractor he is not allowed to do so, *but who is to stop him?*

C. Culmer Hodges,
A.M.I.E.E., A.M.I.Mech.E.

Dawlish, *August 14th*, 1922.

The Sale of Wireless Apparatus.

Your correspondent "Electrical Contractor" seems to have omitted to take the only practical step he can to secure the redress of his grievances. Alone he is powerless to affect the trend of any particular trade current in so large an industry, but as a member of the E.C.A. he would be actively supporting the only organisation working in the interests of the electrical contractor.

So far from taking this common-sense step he appears to scoff at the Association's efforts. He says the Association "cannot assure its members of preferential treatment from wholesale houses." This is exactly what it does, although truly it has not covered the whole ground yet. Every month, almost every day, sees something accomplished in this direction.

He says the Association "cannot discriminate between the electrical sanitary engineer and the genuine electrical engineer." No, the E.C.A. does not attempt this, but it does discriminate between the genuine electrical engineer and the sham. It does not trouble about what other business a man may have, but for membership he must be a qualified electrical contractor.

He claims that "the remedy is as yet beyond the reach of the E.C.A." If he be old enough he should look back at the conditions existing in the trade before the E.C.A. got seriously to work and realise that he owes it at least gratitude.

The remedy your correspondent calls for is being accomplished, and the accomplishment will be complete when "Electrical Contractor" and the rest of his kind—if eligible—take up their membership and share the work.

I shall be very pleased to provide him with an application form and particulars.

Electrical Contractors' Association (Inc.),
Leonard G. Tate,
General Secretary.

London, W.C.1., *August 10th*, 1922.

It would be interesting to know if there is any firm or firms which make a business of installing wireless telephonic receiving sets in private houses? I presume all sets so installed be provided with lightning arresters as damage from this cause is not uncommon?

D. R. Broadbent.

London, S.W.1,
August 12th, 1922.

Removal of Static Charge.

Replying to "F.W.F.," I would suggest employing a number of discharge points, effectively earthed, to the tank or otherwise. These may be obtained by securing a series of needles to a metal base supported upon a portable stand. When the discharging part of the rinsing process is about to begin, so place the stand that the needles are pointing downwards towards the liquid. The distance between the points and the liquid need not be less than the distance of the points at which the spark occurs. Another way of obtaining the points is to secure some asbestos or mica wool and bind it to a portable base by means of twisted strands of wires, all common to earth. The asbestos or mica forms the necessary points. This method will be found very effective, and a careful application of it will meet with success. The action is as follows:—The charge on the surface of the liquid induces an opposite charge on the points. This opposite charge is so intense upon the points that the molecules of air about them are broken up into positive and negative parts, and portions which are unlike in sign to those on the points are attracted towards them, portions of like sign being repelled, thus neutralising the charge upon the surface of the liquid.

Wilfred Pinkerton.

Manchester, *August 11th*, 1922.

The Registration of Contractors.

Why does or did the heading of your interesting leader of the 11th inst. terminate with "Contractors?" I submit that "Installation Undertakings" would be more in keeping with the subject matter. An abbreviated letter by myself, which you kindly published in your issue of the 4th inst. had some bearing on this, to my mind, all-important subject. Unquestionably, the supply authorities are those most intimately concerned, and should, I consider, subject to the Electricity Commissioners' approval, be the referees in all matters relating to the industry, and study the interests of the actual consumer. The supply authorities are the only parties which are sincerely anxious to avoid "The Fusing of Electric Wires." With the exception of quite a small minority the country is saturated with so-called contrators, whose sole desire it is to get so much v.i.r. cable, lampholders, &c., into an establishment, to get it paid for, and to wish the payee a very rude good-bye. You refer to the formation of a registration authority as tending to make installation work a "closed" industry. Surely this would be all to the good from all points of view if by so doing the standard of installation work were raised. At present the industry is handicapped by a multiplicity of ambiguous rules and regulations, which indirectly are interpreted and looked after by members of that excellent association generally known as the E.P.E.A. Broadly speaking, I submit that until supply authorities have real powers to insist on good work, including the condemning of old-fashioned and dilapidated installations, little can be done to ensure safety and continuity of operation. Local advisory committees are bound to meet with adverse criticism and friction. Unless there is an absolute leak on an installation, a supply authority can do absolutely nothing in the direction of improving matters.

Walter E. Rogers, A.M.I.E.E.

London, W.12,
August 13th, 1922.

Do you not think that your leader of August 11th, on the proposed scheme of registration of electrical contractors, is a little unfair to the interests concerned? You suggest that the parties forming the licensing authority will be responsible for seeing that the contractor does his duty, but a study of the scheme will show that this is not so. Supply authorities as members of the Licensing Committee will have a say as to who shall be registered and who shall not, but it has not been suggested that any supply authority shall have more power or responsibility than at present with regard to installation work.

True, if any complaint is made regarding any particular registered contractor, and the supply engineer in the district is upon the local advisory committee he might be called upon to make a report, but he would not do so in his capacity as supply engineer, and would not have power even to examine the installation except at request, or by grace of the owner.

Contractors would not tolerate any additional powers to supply authorities as part of the scheme nor could they support anything in the nature of fresh regulations. As contractors foresee the working of the scheme it will require of its registered members observance of a certain minimum standard extracted from the Institution Wiring Rules, certainly not the creation of new rules or the enforcement of the whole of the existing rules.

Examination of the scheme will show that it is in no way an E.C.A. matter and leaves the door wide open for any man capable of carrying out contracting work to register, and to hold his registration so long as he maintains a minimum standard of workmanship.

Electrical Contractors' Association (Inc.),
H. Marryat,
President.

London, W.C.1.,
August 14th, 1922.

BUSINESS NOTES.

Bankruptcy Proceedings.—J. E. Rollinson, electrical engineer and contractor, 5, Tavistock Chambers, Beastmarket Hill, Nottingham.—First meeting August 21st, at the Official Receiver's offices, Nottingham; public examination October 5th, at the County Court House, Nottingham.

A. E. Blower (Blower & Cooper, electrical engineers and merchants), late of 1 & 3, Pauls Bakehouse Court, Godliman Street, E.C.—Last day for proofs for dividends August 29th. Trustee: Mr. W. P. Bowyer, Senior Official Receiver, Carey Street, W.C.

G. F. Coupe, electrical engineer, 2, Spring Gardens, Stockport.—Last day for proofs for dividend August 26th. Trustee: Mr. J. G. Gibson, Official Receiver, Byron Street, Manchester.

Frank Rawcliffe, electrical engineer, trading as Frank Rawcliffe & Co., 8, Nun Street, Newcastle-on-Tyne.—The adjourned public examination of this debtor was held recently at the County Court, Westgate Road, Newcastle-on-Tyne. Debtor was questioned with reference to the sale of a business to a former partner, and it was stated that he had furnished accounts of his transactions with this partner. He stated that he had made out the accounts from his late partner's books. With regard to transactions with another company debtor said he intended becoming a partner, but the arrangement fell through. After further questions the examination was again adjourned.

The *London Gazette* contains a notice to debtor "in lieu of personal service of bankruptcy notice and petition and of application to commit for contempt of Court" in the following: E. Durden & Co., 13, Queen Street, Liverpool, electrical engineers; Liverpool Court. Substituted service of bankruptcy notice directed August 1st. Bankruptcy notice served by Messrs. Downes & Davies, electrical fittings factors, 1, Stanley Street, Liverpool.

Frank Porter, electrical engineer, 17, Goldhawk Road, Shepherd's Bush, and 23, Cromwell Avenue, Hammersmith, W.—The first meeting of creditors under this failure was held on August 14th before Mr. Vyvyan, Official Receiver, at the London Bankruptcy Court, when accounts were submitted showing unsecured liabilities £696, and preferential claims £69, against assets valued at £226, and consisting of cash, £32; stock, £30; furniture, £100; and book debts, £64. The chairman reported that the debtor filed his own petition on July 28th. He commenced business in August, 1921, with a partner, under the style of "Porter & Simpson," at 23, Cornwell Avenue, Hammersmith, and they traded as electrical engineers until the following October, when Mr. Simpson withdrew and the debtor continued the business alone. He had stated that, owing to lack of working capital, the business was not a success, his failure being further due to insufficient business knowledge and slackness of trade. The case was left in the hands of the Official Receiver to be wound up in bankruptcy. The creditors include:—

	£		£
Colley & Co.	62	Huddleston & Co., P.	51
Electro Generator Co.	33	Hedberg, Trevor	15
General Electric Co., Ltd. ...	47	Kent, Frank	40

F. A. Watkins, electrical engineer, 57, High Street, Hythe.—Receiving order made August 10th on debtor's own petition. First meeting, August 24th, at the Official Receiver's office, Canterbury; public examination, September 23rd, at the Guildhall, Canterbury.

R. V. Mayner, electrical engineer, 62, Harris Street, Peterborough.—First and final dividend of 1s. 5d. in the £, payable August 22nd, at the Official Receiver's office, 5, Petty-cury, Cambridge.

Company Liquidations.—The Horton Manufacturing Co., Ltd.—Liquidator appointed May 10th.

Rendle, Blanchard & Co., Ltd.—Winding up voluntarily. Liquidator, Mr. F. Barnes, Balfour House, Finsbury Pavement, E.C. Meeting of creditors is called for August 24th at Balfour House. Particulars of claims to the liquidator by September 21st.

Dissolutions of Partnership.—Bland & Lewin, electrical motor engineers and garage proprietors, South Knighton Garage, Knighton Church Road, and Goldhill Road, Leicester.—Mr. E. Bland and Mr. J. Lewin have dissolved partnership. Mr. Bland will attend to debts.

H. Cleminson & Co., electrical and mechanical engineers, 315a, Stretford Road, Hulme, Manchester.—Messrs. J. H. Fleming and H. Cleminson have dissolved partnership. Debts will be attended to by Mr. Fleming, who will continue the business.

Receiver Appointed.—British Scientific Industries, Ltd., St. John's Works, Headingley, Leeds.—In July Mr. Alfred Dobson, of 10, Park Row, Leeds, was appointed receiver for the debenture holder.

Trade Announcements.—The British Engineering Products Co., of 26, Westminster Palace Gardens, Victoria Street, London, S.W.1, has taken over the commercial engineering section of Sir J. F. Payne Gallwey, Brown and Co., Ltd., 58, Victoria Street, S.W.1.

Messrs. H. T. Boothroyd, Ltd., dynamo and motor manufacturers, ask that all communications should be addressed to them at their works at Bootle, Liverpool, for the present, as they have discontinued their agency agreement with Sir J. F. Payne Gallwey, Brown & Co., Ltd.

Messrs. Paterson & Service, of 38, Bath Street, Glasgow, state that the Electric Lamp Manufacturers' Association of Great Britain, Ltd., has appointed them wholesale distributing factors for all E.L.M.A. lamps.

The Eddystone Lamp Co., electrical appliance manufacturers, has opened a branch establishment in Mincing Lane, Blackburn.

Messrs. Poulden Bros. have taken a five-floor building in Great Eastern Street, E.C., suitable for showrooms, part of which will be allocated to wholesale business in wireless apparatus.

Catalogues Required.—The Allied Electric Manufacturers, of 3, Paradise Square, Sheffield, ask for catalogues and lists.

Catalogues and Lists.—Electric Control, Ltd., Hastings House, Norfolk Street, Strand, W.C.2.—An illustrated descriptive booklet dealing with "Empire" automatic control gear for various purposes.

Messrs. Leslie McMichael, Ltd., Providence Place, West End Lane, Kilburn, N.W.6.—An illustrated and priced catalogue of wireless apparatus.

Messrs. Richson & Co., 114, New Oxford Street, W.C.1.—A beautifully-produced catalogue, containing illustrations of selected glassware for lighting purposes. The publication includes chandeliers, bowls, coloured glass, and a number of novelties.

Messrs. F. & A. Parkinson, Ltd., Guiseley, Leeds.—An illustrated brochure written in a non-technical style for prospective users of a.c. motors.

Messrs. Landis & Gyr, Ltd., Elgee Works, Hampton Hill. An illustrated pamphlet giving particulars of time switches and limiters.

The English Electric Co., Ltd., Queen's House, Kingsway, W.C.2.—Publication No. 367, dealing with "English Electric" turbo-blowers; and Publication No. 370, describing the electrical driving in Scottish woollen mills.

The Key Engineering Co., Ltd., Mansion House Buildings, 4, Queen Victoria Street, E.C.4.—An illustrated pamphlet dealing with socket and spigot joint conduit and troughing, and sleeve-joint conduit.

Messrs. Gyer, Hill & Gyer, 661-3, Harrow Road, Willesden, N.W.10.—A comprehensive catalogue of surplus Government stores, including machines, tools, boilers, hose, &c.

London Electric Stores, 23a, Oxendon Street, Haymarket, S.W.1.—An illustrated leaflet dealing with receiver headgear for wireless telephony.

Berry's Electric, Ltd., 85-86, Newman Street, W.1.—List No. 2,271, a catalogue and price list of "fool-proof" switchgear and switchboards.

Messrs. Wates Bros., 13-14, Great Queen Street, Kingsway, W.C.2.—A well-illustrated price list of wireless sets and component parts, dealing especially with primary and secondary batteries.

Mr. O. N. Beck, 11, Queen Victoria Street, E.C.4.—An illustrated pamphlet describing the "Universal" electric boiler scaler.

The Relay Automatic Telephone Co., Ltd., Marconi House, Strand, W.C.2.—A well-illustrated brochure describing the "Relay" system.

Unemployment.—The latest Ministry of Labour returns show that the total number of unemployed persons on August 7th was 1,328,000. This was a reduction of 23,831 on the week and 495,133 fewer than in the first week in January last. Short-time workers numbered 69,100—a reduction of 1,500—comparing with a total of 934,786 in July, 1921.

Patent Restoration.—An order has been made restoring Patent No. 18,278 of 1908, granted to Johann Kremenezky for "improvements in the process of sealing the filament carrier into the bulb of electric incandescent lamps."

Copper and Lead Prices.—Messrs. F. Smith & Co. report: (August 15th):—Copper (Electrolytic): Bars, £71, £1 decrease; ditto ditto sheets, no change; ditto ditto wire rods, £81, £1 decrease; ditto ditto H.C. wire, 10¾d., 1/16d. decrease.

Messrs. James & Shakespeare report, August 16th:—Copper bars (best selected), sheet and rod, no change. English pig lead, £26, 10s. decrease.

E.D.A. Activities.—The most recent pamphlets issued by the British Electrical Development Association deal with many phases of the use of electricity. A useful suggestion is contained in a pamphlet entitled "Give Your Consumer a Unit a Year" (E.D.A. 293). The idea is to expend upon publicity which will benefit the consumer a sum equivalent to the price of a unit for every consumer, and the way, or several ways, in which this can be carried out with the aid of the E.D.A. are set forth. Two interesting publications deal with electric cooking in a practical manner, one of them (E.D.A. 289) relating to cooking on a large scale, as in restaurants, and the other (E.D.A. 295) to domestic service. Lighting is represented by a reprinted lecture given recently by Mr. C. H. Yeaman (Stoke-on-Trent) (E.D.A. 268), and by E.D.A. 265, advocating the use of electric lighting in shop windows during the evening hours. Another pamphlet (E.D.A. 290) details some of the many uses to which automatic electric welding may be put. A general electrical advertising device is a well-coloured postcard (E.D.A. 292).

B.T.H. Magnetos.—The British Thomson-Houston Co., Ltd., informs us that further successes were attained in the "Aerial Derby" of August 7th by machines fitted with B.T.H. magnetos, this being the fourth occasion of the kind in which the first and second prize-winners have had these magnetos on their machines.

Chinese Notes.—The Chang Ming Electric Co., of Changhing, Chekiang, has completed its preparations. Work will soon be started.

The Lingping Electric Co., of Lingping, Chekiang, has applied to the Chekiang Board of Industry for registration.

German Trade with Australia.—According to Reuter, the first consignments of goods from Germany which have arrived at Melbourne consist of small parcels, the German merchants apparently being anxious to feel their way at present.

For Sale.—By direction of the Disposal Board, Messrs. Bowler & Blake will sell by auction, on August 22nd and following days, at H.M. Dockyard, Portsmouth, H.M. Gunboat Yard, Haslar, R.A.O.C. Depôt, Hilsea, and the Seaplane Training School, R.A.F., Lee-on-the-Solent, machinery and electrical equipment. (See our advertisement pages to-day.)

New French Companies.—With a capital of 2,700,000 fr., all subscribed in currency, the Société l'Electricité at Villars (Vosges), has been formed for the erection and working of electric distribution networks.

The Société rurale de Distribution d'Electricité has been constituted at Lencloitre (Vienne) for the distribution of energy in the region named. The capital of the concern is 150,000 fr.

Under the style of Société Commerciale de Lampes et d'Appareillage Electriques, a company has been formed at Paris (97, Rue de Lille) to take over the assets of the Société Commerciale d'Appareillage et de Lampes Electriques Marque d'Or (now in liquidation). The capital of the company is 100,000 fr.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions associated with the electrical trades and industries. Notices of objection to any of the applications can be entered within one month of the dates mentioned below:—

M.V. & M.V.E.C. (lettering and design). Nos. 426,319 426,320, 425,321, 426,322, and 426,323. All goods in Classes 5, 14, 15, 16, and 40. Metropolitan-Vickers Electrical Co., Ltd., 4, Central Buildings, Westminster, S.W. August 2nd, 1922.

South African Electricity Undertakings.—The Association of Municipal Electrical Engineers (Union of South Africa) has sent us some useful information which is supplementary to the Official South African Municipal Year Book. The matter consists of a number of tables containing exhaustive details of the municipal electricity supply undertakings of the Union. The information includes particulars of generating plant, prime movers, supply voltages, &c., as well as a mass of financial statistics. One list gives details of tariffs which make an interesting comparison with British charges.

Licensing Electrical Contractors in New South Wales.—A deputation from the Electrical Employers' Association of New South Wales waited upon the Minister for Mines recently asking that a Bill be introduced providing for the issue of licences to electrical contractors.

Mr. A. Waddell, chairman of the Association, said it had been felt for years that there should be at least as much control over the installation of electrical equipment as there was over plumbing. The workmen themselves also wanted licences, but the Association objected to that on the ground that it would only give the employés an additonal lever to go before the Court and ask for higher wages. He pointed out that the City Council and municipalities had power to bring in a scheme for the issue of licences, and in certain municipalities schemes had been started. The Association was afraid that unless something comprehensive were done quickly there would be numerous schemes of a varied character in operation throughout the State, whereas a uniform scheme was required to deal effectively with the question. At the present time an individual without any qualifications could carry out electrical installations. The suggestion was that a board of control, with power to issue licences for the whole of New South Wales, should be appointed. A licence fee could be charged, and the scheme could be introduced without cost to the Government.

Mr. Fitzpatrick said he was thoroughly in sympathy with the project. There seemed no justification for leaving the electrical contractor out of the registration scheme. He undertook to give instructions for a Bill along the lines suggested to be prepared, and to submit it for possible alterations to the Association before placing it before Parliament. He saw no necessity for the licensing of the employés, as the contracting firms should take the responsibility. By the operation of the Act when it was passed it would be possible to squeeze out the firms which were incompetent and those which were dishonest. He could not give an assurance that the passage of the Bill would be secured this session, but he would try to have it put through.—*Industrial Australian and Mining Standard.*

New Belgian Company.—There has been formed at Genappe the Société Anonyme Genappe Electrique II., with a capital of 287,400 fr., with the object of working generating installations, distributing motive power, and the sale and erection of electric meters, motors, &c.

Book Notices.—The *Journal* of the South African Institution of Engineers Vol. XX, No. 12, July, 1922. Johannesburg: The Institution. Price 2s.—In this number is presented the annual report (1921-22) and the balance sheet. It also includes the result of the ballot for officers and the valedictory address of Mr. R. C. Atkinson, the retiring president, and a statement presented to the Select Committee dealing with the South African Electricity Bill.

The *Transactions* of the South African Institution of Electrical Engineers, Vol. XIII. Part 4. June, 1922. Johannesburg: The Institution. Price 2s.—This part contains a paper on "Direct-current Lifts," by Mr. H. M. Missing; and a discussion on the South African Electricity Bill, embodying a statement by Mr. B. Sankey, the municipal electrical engineer of Johannesburg.

"Some Things that Matter," by Lord Riddell (187 pp.). London: Hodder & Stoughton, Ltd. Price 7s. 6d. net.—This work, which consists mainly of articles reprinted from a weekly periodical, contains much that is useful and much that may be classed as "counsels of perfection." The main theme is mental discipline, but this is not considered in the abstract merely, nor is the treatment highly psychological; the distinguished author endeavours to implant principles which will be of use when applied to everyday and special occasions. Among the subjects so dealt with are the correct methods of reading; the art of public speaking; the intelligent use of facts in forming conclusions; and the development of the powers of observation. In common with other authorities Lord Riddell considers the study of law to be the best medium of mental training, and, therefore, legal matters occupy a large part of his book. The laws of evidence are succinctly set forth, legal maxims are explained, and many other matters are dealt with in an interesting manner, quite characteristic of the author himself. It is probable that Lord Riddell will succeed in interesting and assisting many who are frightened or the phrase employed by most writers on the subject of mind training.

"The Brown, Boveri Review," July, 1922 (16 pp.). London: Brown, Boveri & Co., Ltd.—The illustrated articles appearing in this number are "Brown, Boveri Marine Turbines" and "Improved Short-circuiting Devices for Induction Motors." The latter article describes several forms of centrifugal short-circuiting arrangements.

"Technical Electricity," by H. T. Davidge and R. W. Hutchinson. Fourth edition. Pp. xii.+514, 403 figs. London: University Tutorial Press. Price 10s. 6d.

"Cable Spans," by E. Parry, B.Sc., M.Inst.C.E. (17 pp.). London: The English Electric Co., Ltd. (Publication No. 368).—This work embodies practical formulæ and constants relating to suspended wires of different materials, and was originally produced for the use of the New Zealand Government Public Works Department.

"Filtration," by T. R. Wollaston. Pp. x+102; 30 figs. London: Sir Isaac Pitman & Sons. Price 2s. 6d. net.

British Manufacturers' Representatives in South Africa.—We have received a copy of the half-yearly report of the British Manufacturers' Representatives' Association of South Africa (Inc.) (President Mr. H. Edwards, P.O. Box 845, Cape Town.) It shows that at June last the membership was increasing and had reached a total of 440. Four members had resigned because of the introduction into the articles of the "Alien Firms Clause," but these were now reinstated as the clause had been withdrawn. The liaison between the Association and the F.B.I. has so far been a purely tentative one, but the presence of one of the past presidents (Mr. H. R. Brown) in London has been taken advantage of to have the whole matter thoroughly gone into. The Association has devoted a good deal of attention to the agitation for protective duties, is preparing a register of firms represented by its members, new sample rooms are to be opened in Durban, and in many other ways the organisation is watching over the interests of its members.

German Electrical Prices.—The Price Centre of the Central Association of German Electro-Technical Industry has decided to increase prices from August 1st by about 30 per cent.—*Frankfurter Zeitung*, August 3rd, 1922.

Installation Contracts.—Messrs. Francis Polden and Co., Ltd., have secured the contract for the electrical equipment of the new extension at Olympia.

Other important installations being carried out by the company are; the new building for the Guardian Assurance Co., in the City; the National Safe Deposit Building, Aldwych House, Kingsway, and other London buildings; Hook End Farm, Reading; Roffey Park, Horsham; Dr. Barnardo's Homes, Goldings; Mill Hill School, &c.

The A.E.U.—The Executive Council of the Amalgamated Engineering Union has had under consideration the immediate and future position of the organisation due to events which accompanied the recent lock-out, and especially the causes which had led to a serious reduction in the membership. Just before the trade depression the union had a record membership of more than 450,000. Unemployment steadily reduced these figures, and the lock-out increased the number of defections. At the end of last month the total membership was 381,000, or 11,000 less than in the previous month. It has now been decided to invite suggestions from the rank and file with regard to reconstruction, and it is possible that the first step that will be taken will be for the union to associate itself actively with the other organisations in the industry. —*Westminster Gazette.*

Our Foreign Trade.—July Figures.—The following were the values of imports and exports of electrical goods and machinery during July, 1922:—

	July, 1922.	Inc. or dec.	Inc. or dec. 7 months 1922.
Imports.	£	£	£
Electrical goods and apparatus	110,337	– 4,415	– 628,045
Machinery	635,002	– 218,705	– 3,199,545
Exports.			
Electrical goods and apparatus	596,274	– 621,317	– 4,585,437
Machinery	3,191,042	– 2,939,670	– 18,086,380
Re-exports.			
Electrical goods and apparatus	8,835	– 3,940	– 42,608
Machinery	99,902	– 12,413	– 113,531

A German Amalgamation.—The Electricity Installations Co., of Berlin, is increasing its share capital to 65,000,000 marks for the absorption of the German Telephone Works, Ltd., and the German Cable Industry, Ltd., and the name is being changed to that of the German Telephone Works and Cable Industry Co.

Farm Lighting Plant for Algeria.—U.S. Vice-Consul David C. Elkington, Algiers, reporting in June last, referred to the market for small pumping plant. France leads in the sale of pumps to Algeria, with the United States and Great Britain next, and supplying about equal quantities. There are only three American makes known in the country, while the principal ones from other countries are the Audemard, Guyon, Jandin, Japy, Dumond, and Rateau—all French; and the Worthington-Simpson (British). The sources of motive power in Algeria are steam, gasoline, and "poor" gas, which is a product of the distillation of coal, but is less powerful than the gas originally used for cooking. In Algeria steam is generated by wood, charcoal, coal, fuel oil, and gas oil, named in the order of their importance. Electric motors are not often found in the colony, for the current to run them is not obtainable outside of the larger cities, although country districts are being gradually supplied. The farms which possess independent power and lighting plants are few, but this kind of equipment should have a good market, because of the present lack of electric current throughout a large part of the country. With good crops and favourable exchange the Algerian farmer will prove a good customer for pumps and farm lighting plants. Credit terms usually expected are from 60 to 90 days for purchases, though special arrangements are made for agencies and consignments.

LIGHTING AND POWER NOTES.

Australia.—Queensland.—Ministerial consideration is being given in Queensland to a new scheme, which the Northern suburban local authorities in Brisbane have placed before the Minister for Works, for the installation of an electricity supply system in their respective areas.—*Reuter's Trade Service* (Melbourne).

Swan Hill.—The town of Swan Hill, in Northern Victoria, is to change its existing direct current system to a three-phase, 400/230-volt alternating current system, at an estimated cost of £17,000. Two crude oil engines of 200 b.h.p., and one of 180 b.h.p. will be installed.—*Reuter's Trade Service* (Melbourne).

Barrow-in-Furness.—Year's Working.—The accounts for the year 1921-22 of the municipal electricity undertaking (engineer: Mr. H. R. Burnett) record a total revenue of £77,122—considerably less than that of the previous year—£87,068. Working costs, however, decreased in greater proportion, being £51,010, as against £68,663. Of the gross balance of £26,112 (£18,405), capital charges absorbed £25,738 (£20,944), leaving a net profit of £374, comparing favourably with a deficit of £2,539 in 1920-21. The amount of energy sold fell from 9,282,017 to 6,886,504 kWh, the decrease being due to reduced power sales; private supply showed an increase.

China.—Hanyang.—The Government Bureau of Economic Information reports that 150,000 dollars are being raised at Hanyang, Hupeh, for the installation of an electric light plant.—*Reuter's Trade Service* (Shanghai).

Chudleigh.—Application for Order.—The Newton Abbot Rural Council has decided to support an application by the Chudleigh Electric Light & Power Co., Ltd., for a Special Order to supply electricity to the district.

Crieff (Perthshire).—Electricity Supply.—The Town Council has agreed that the installation and operation of the burgh electricity supply be entrusted to a company to be formed in co-operation with Edmundson's Electricity Corporation, Ltd., on terms to be arranged. It is proposed to form a local company, with a capital of £10,000.

Continental.—France.—A concession has been applied for by the Société Générale d'Enterprises for the erection of a network to serve upwards of 90 villages in the *départements* of Morthan and Côtes du Nord with electricity.

Belgium.—An electricity scheme is shortly to be established in the town of Houx, province of Namur.

Dundalk.—Year's Working.—The annual report on the working of the electricity undertaking for the year ended March 31st last shows a total income of £19,459. Working expenses amounted to £14,747, leaving a gross profit of £4,712. After deduction of capital charges there was a net profit of £769.

Elgin.—Electricity Scheme.—The promoters of the new electricity supply company having been successful in raising the minimum amount, a company has been formed. It is expected that the company will be in a position to supply electricity by November.

Featherstone.—Street Lighting.—The Urban Council has accepted the offer of the Electrical Distribution of Yorkshire, Ltd., for street lighting with 214 lamps of 50 c.p., at £4 each per annum.

India.—Bengal.—A special grant for the hydro-electric survey of Bengal has been sanctioned.—*Reuter's Trade Service* (Bombay).

King's Lynn.—Year's Working.—The annual report on the working of the electricity undertaking for the year ended March 31st last shows a total income of £16,262, as compared with £16,660. Working expenses and capital charges absorbed £15,718, leaving a net profit of £544. The number of kKh sold decreased from 882,315 to 837,067. The cost of generating electricity dropped from 2.769d. to 1.970d. per kWh.

Llanarth.—Mains Extensions.—At a recent meeting of the Urban District Council it was decided to obtain an estimate of the cost of extending the electricity mains to Nantyrhebo, a suburb of the town.

Portsmouth.—Year's Working.—The accounts of the municipal electricity department (engineer: Mr. B. Handley) for the year ended March 31st last, record a total income of £123,756, as compared with £114,384 in the previous year. The working expenditure amounted to £85,966, as against £91,405, leaving a gross profit of £37,790 (£22,979). After deducting capital charges the result was a net profit of £15,740, comparing very favourably with a surplus of £2,072 in 1920-21. This enabled the department to eliminate a deficit brought forward and to transfer £14,438 to reserve. A total of £92,571 was spent on capital account; this included items of £69,052 for machinery, and £21,725 for mains and services. The amount of energy sold was 5,214,138 kWh, as compared with 4,885,782 kWh, and the maximum demand increased from 3,410 to 4,055 kW.

Penypont.—Proposed Temporary Scheme.—The consulting engineer to the Council recently reported on the scheme for electricity supply to Newcastle Higher, the recommendation was that the Council should only prepare a temporary scheme at present and defer the erection of a new generating station. The question was referred to a special committee.

Ripon.—Purchase of Plant.—The City Council has approved a recommendation by the Electricity Committee that an offer of £3,000 be made to the War Office for the North Camp electricity plant as a going concern, including machinery, equipment, cables, land, and buildings, together with the weir in the river Laver, and the right of impounding and taking water from the river, at present held by the War Office.

Shrewsbury.—Year's Working.—The total income of the electricity undertaking for the year ended March 31st last amounted to £23,278. Working expenses amounted to £18,248, leaving a gross profit of £5,030. After providing for interest and sinking fund contributions there was a net profit of £1,259.

Southport.—Temporary Supply.—The Electricity Committee has granted the application of the Birkdale Electricity Supply Co. for a temporary supply of electricity to Birkdale, for the purpose of night loads, on terms to be arranged with the borough electrical engineer.

Taunton.—Price Reductions.—The Town Council has reduced the charges for electricity as follows:—Lighting: up to 25 kWh per quarter, 10½d. per kWh; 25 to 500, 7½d.; 500 to 1,000, 6½d.; beyond, 5d. Power: Under 2,000 kWh per quarter, 3½d.; 2,000 to 4,000, 2½d.; beyond, 2¼d. Cooking and heating: First 50 kWh per quarter, 3½d.; beyond, 1½d.

United States.—Large Hydro-electric Generators.—The Niagara Falls Power Co. has placed an order with the General Electric Co. for two 65,000-kVA, 12,000-volt vertical water-wheel generators, the largest ever built, to be used in an extension to its power house No. 3 at Niagara Falls, N.Y. These generators will be driven by 70,000-h.p. hydraulic turbines, made by the I. P. Morris Department of the William Cramp & Sons, Ship & Engine Building Co., Philadelphia. Each generator will weigh about 700 tons, being 35 ft. in diameter and 26 ft. high. It is interesting to note that the new generators are twice the capacity of the three 32,500-kVA generators now contained in Station No. 3, which at the time of their installation were considered the largest in existence.—*Journal of Electricity and Western Industry.*

West Bromwich.—Year's Working.—The annual report on the working of the electricity undertaking for the year ended March 31st last shows a total revenue of £72,957, as compared with £86,753 in the previous year. Working expenses amounted to £52,625 (£67,382), leaving a gross profit of £20,332 (£19,370). After providing for capital charges there was a net profit of £6,775, which was transferred to appropriation account.

Wynyddislwyn.—Electricity Supply.—At a meeting of the District Council the question of electricity supply to Oakdale was discussed. It was stated that 90 per cent. of the residents were desirous of changing from gas to electric lighting as soon as the installations could be made. The wiring charge for five lights in a collier's dwelling would be £5, and the Council expressed the opinion that the contracting company should arrange with the residents for an instalment system of collecting this sum.

TRAMWAY AND RAILWAY NOTES.

Australia.—Melbourne.—The Melbourne and Metropolitan Tramways Board has submitted to the Minister of Public Works an interim report on the electrification of the cable tramways, and the construction of the more urgently required of the electric lines. The Board's estimate of the cost of electrifying the cable tramways is £4,200,000. The cost of about 30 miles of new electric tramway, with additional rolling stock, is placed at £2,000,000. It is proposed to spread the expenditure over 15 years. The total proposals before the Board represent 153 miles of single track. With regard to conversion, it is proposed that the first lines shall be those which link up present electric systems.—*Reuter's Trade Service* (Melbourne).

Continental.—Sweden.—According to *Svensk Handelstidning*, an official of the State Railway Board, who has recently been visiting some of the largest engineering works in the country, emphasised the fact that in order to meet probable unemployment in the engineering industry, it was necessary that the electrification of the railway line between Stockholm

and Gothenburg should be started in the very near future. The cost of the electrification of the line in question was originally estimated at Kr.105,000,000, including the locomotives, but as a result of the turn in the market the present cost would only amount to about Kr.50,000,000.—*Reuter's Trade Service* (Stockholm).

Edinburgh.—Inquiry.—An inquiry was recently held in Edinburgh into the Corporation's application for a Provisional Order to include an arrangement by which the Corporation would be empowered to take over the undertakings of the Musselburgh & District Electric Light & Traction Co., Ltd., in a number of adjacent districts. The Commissioners, after deliberation, found the preamble of the Order "not proved" as regarded this clause.

Japan.—Railway Electrification.—*Finance and Commerce* learns that an extensive electrification project has been adopted by the Japanese Department of Railways, and will be carried out with the work of electrifying the Tokio-Odawara and the Tokio-Yokosuka lines. The new project covers the whole Tokio-Kobe trunk line. The total expenditure for the trunk line electrification is estimated at 67,000,000 yen. Of this amount 35,000,000 yen is required for the construction and improvement of locomotives and cars. The number to be built is estimated at 291, including freight cars, passenger cars, express locomotives, special express train locomotives and others. If the financial scheme is approved by the Finance Department part of the amount will be included in the Budget for the year 1923-24. The whole expenditure is to be spread over a period of seven years. According to the plans, the work is to be started with the erection of overhead cables along the present tracks from both terminals. Most of the power is to be obtained from private power companies along the line, about 25 transformer stations being required between Tokio and Kobe.—*Reuter's Trade Service* (Shanghai).

London.—L. & N.-W. Railway Electrification.—A commencement has been made of the electrification of the L. & N.W. Railway line, between Watford and Croxley Green—a distance of about two miles. The construction of a further ten miles of electrified line is under consideration.

Tube Breakdown.—The service on the Central London Railway between Liverpool Street and the Bank was suspended from 9 a.m. to mid-day on the 14th inst., owing to one of the axles of a train running from Wood Lane breaking. The passengers were conducted through the tunnel to Liverpool Street station.

New Zealand.—Wellington.—A Power Station and Tramway Committee appointed by the City Council to investigate the general control and conditions of the tramway services in the city, has made the following recommendations:—Car shed extensions, estimated cost £25,000; new cars, £84,000; duplication of lines, £25,000; construction of limited number of double-deck cars to cope with rush traffic.

When the Mangahao hydraulic-electric scheme is completed the Council will take the power for its tramways from this source. Three rotary converters will be installed. It is estimated that the largest will cost from £50,000 to £60,000.—*Reuter's Trade Service* (Melbourne).

Pontypridd.—Track Renewal.—At a recent meeting of the District Council the electrical engineer reported on the dangerous state of part of the tramway track, particularly at Paulshoughton and Taff Street, the main street of the town. It was decided to immediately renew the former portion of the track and the question of Taff Street was referred to the Tramways Committee.

Sheffield.—Flood Damage.—During the recent heavy floods in the North of England the tunnel conveying some of the Corporation's cables under the River Don, from the Kelham Island station, became flooded, causing an interruption to the tramway system. The tramways were also damaged by the action of the torrents.

South Africa.—Capetown.—The *Cape Times* reports that Mr. Jagger (Minister of Railways and Harbours) recently received a joint deputation from the Chamber of Commerce and the Peninsula Publicity Association on the question of the electrification of the Peninsula surburban line. He intimated that the capital outlay involved by the proposal placed it outside practical politics at present. The Government now had the Natal electrification scheme in hand, and it was anticipated that that project would be completed in about two years. If the scheme proved a success no doubt the electrification of the Peninsula suburban line would afterwards be undertaken.—*Reuter's Trade Service* (Capetown)).

United States.—Railway Electrification.—The *Journal of Electricity and Western Industry* states that it is proposed to commence in 1924 the electrification of the American Great Northern Railway. The total estimated cost is $20,000,000. The first stage will be between Whitefish and Havre (Montana), and the second step from Wenatchee to Seattle, Washington. Seattle will be established as the western terminal for the distribution of electrical equipment.

TELEGRAPH AND TELEPHONE NOTES.

Atlantic Cables. — Florida-Barbados Route.—President Harding has granted a request for the immediate reopening of the cable between Florida and Barbados for emergency use for transmitting messages to Europe *via* Pernambuco. This cable was closed during the Wilson Administration, on the ground that the connection of the British cable to Brazil would tend to increase the monopoly of the British company. —*Daily Telegraph*.

Seizure of Stations.—Last week we announced the seizure of the Waterville cable station of the Commercial Cable Co. by the Irish "Irregulars." On the 10th inst *The Times* announced that all the ten Transatlantic cables which end in Ireland were in the hands of the Irregulars, who refused to allow them to be used. As a consequence the only cable communication between this country and the United States was *via* Penzance, where four lines are required to do the work of fourteen. Naturally considerable delays are taking place. Traffic is being diverted to some extent through France, and a larger use is also being made of wireless. The Western Union Telegraph Co. announces that, owing to the congestion on the Penzance cables, the deferred or cheap-rate services are temporarily suspended, and full-rate traffic only can be accepted. The stations which have been seized are those of the Commercial Cable Co., the Western Union Co., and the Imperial cable station, all situated on the Kerry coast. It is not known definitely whether the apparatus has been destroyed, as communication is cut between the stations and headquarters in London.

The Post Office stated on the 10th that the deferred services at half-rates to the United States had been suspended by all routes. Diverted services to Canada and the West Indies were also suspended except by Imperial cable, which is maintaining all its normal services to Canada, the West Indies, and Australasia.

Irish "rebels" seized the Central Telegraph Office in the Dublin Post Office late on the night of the 11th inst. An attempt was made to set the premises on fire, and telegraphic communication was interrupted. Free State troops regained possession and a limited service was in operation next day, the attempt to destroy the apparatus having been foiled. The Marconi Co. is trving to relieve the situation as far as possible, but as the Clifden wireless station has been destroyed all wireless messages have to go *via* Carnarvon.

According to *The Times*, the seizure of the cables in Ireland has had its repercussion on cable communication between France and America. In consequence of the heavy strain on the two direct cables from the French coast the restrictions announced by the Western Union Telegraph Co. on the use of the Penzance cables for messages at deferred or cheap rates are also being applied in France. Fortunately the great wireless station at Saint Assise, near Melun, which opened up direct wireless communication with New York on August 6th, is now in full working order, and has had an unlooked-for opportunity of demonstrating its capacity.

Although normal service has not been restored as yet, the situation has greatly improved this week.

Germany.—New Berlin-Rhine Cable.—The *Matin* announces that the German Government has just opened the new underground cable between Berlin and the Rhine. The work on this line was begun in 1914, but was dropped during the war and resumed in April, 1923. The *Matin* suggests that the purpose of this new cable is strategic as well as economic.—*Reuter*.

Netherlands.—Direct Telephone Service.—*The Times* Amsterdam correspondent announces that direct telephone communication between the Netherlands and England was to be inaugurated on the 14th inst. for public use.

Sweden.—The West Coast Radio Station.—It is stated that no decision has yet been reached by the Swedish authorities with regard to the site for the erection of the projected large wireless station on the West Coast. The competition as to whom shall receive the contract to erect the station is particularly keen, and radio companies in the United States, England, France, and Germany are doing what they can to make their offers as attractive as possible. The French offer was placed before the Swedish Telegraph Administration about the end of July by M. Kyticas on behalf of the Société Francaise Radio Electrique.

A representative of the Marconi Co. is in Stockholm this week in connection with that company's offer to build the station in question, and a representative of the American Radio Corporation was also there for the same purpose recently.

Telephone Strike.—The Telegraph and Telephone Operators' Union, with a membership of about 500, went on strike some time ago, and made great efforts to induce the telephone girls to join it. Contrary to what had been expected, it succeeded, and the strike in Stockholm, as well as in Gothenburg, has lasted since July 21st. The telephone girls wanted collective agreement instead of the personal agreements now in force. The Board of Telegraphs did not agree, especially as there would be an increased cost in connection with it, which would fall upon the subscribers. Besides, wages now paid to the telephone girls are

in 1917 37·92 per cent. higher than they were when the increased cost of living has been considered. The Telegraph Administration, therefore, declared that those who wanted to resume work had to appear before a certain time, but the Government said that there would be no objection to a collective agreement, and thus the settlement of the strike was postponed, and the Telegraph Workers' Union insists that all the telephone girls shall be taken back to work immediately and no difficulties whatever be made on account of their having taken part in the strike. This the Board cannot promise, as it will have to give work to those who have helped over the strike. It is 25 years since the last and only previous telephone strike took place, and nothing was gained by it, says the *Financier*.

The Telephone Service.—Irlam Telephone Exchange.—A new telephone exchange was opened at Irlam on August 12th. Provision has been made for the immediate connection of 52 subscribers, including those existing subscribers in the Irlam and Cadishead districts who have hitherto been served from the Urmston Exchange.—*Manchester Guardian.*

New Wembley Exchange.—A new telephone exchange, with accommodation for 1,200 lines, was opened at Wembley, Middlesex, on the 16th inst.

Wireless Telephony.—Broadcasting.—Amateurs, whose patience has been tried by the long delay in getting the broadcasting scheme started, will learn with relief that their anxieties are now within measurable distance of an end, says *The Times*, according to which broadcasting in the London area will begin on August 21st, and in the seven provincial areas in six or seven weeks. Such, at any rate, is the expectation of the manufacturers who, on August 11th, combined to form the broadcasting company. Marconi House will be the broadcasting centre for London. The apparatus is in readiness, and all that remains to be done is to secure the Postmaster-General's approval of the company's memorandum and articles of association. Mr. Godfrey Isaacs, managing director of the Marconi Co., stated on Saturday that he did not anticipate any obstacle to the scheme being inaugurated next Monday. The board of directors of the new company will then proceed to deal with the erection of the provincial stations, which are to be at Birmingham, Manchester, Newcastle, Plymouth, Cardiff, Edinburgh or Glasgow, and Aberdeen. Each station will cost, according to Mr. Isaacs, approximately £20,000, and it was estimated recently by Mr. Kellaway that within the next two years the sum of £6,000,000 will be spent on receiving sets and broadcasting stations, 80 per cent. of which amount will go in wages. The Postmaster-General has laid down several conditions under which the broadcasting company will work. In the first place, its profits are limited to 7½ per cent. per annum. For two years the apparatus will be limited to types submitted for the approval of the Post Office by members of the broadcasting company, but to avoid anything in the shape of a monopoly the Postmaster-General has laid it down that any *bona-fide* British manufacturer of wireless apparatus must be allowed to become a member of the broadcasting company simply by taking a £1 qualifying share. The licence of the company will be subject to the maintenance of an efficient service. Towards the expenses of the broadcasting company the Post Office will contribute a portion of the licensing fees paid for receiving sets, and a further contribution will be paid out of the purchase money on each set sold by the manufacturers.

Senator G. Marconi has, according to the *Evening News*, been elected chairman of the new broadcasting company. Until the position of the latter has been definitely established the Postmaster-General will not issue licences for the reception of wireless matter in any public place of entertainment.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—December 18th. Victorian Electricity Commissioners. Supply of a complete brown coal-handling plant.

November 4th. Transformers, induction regulators, and switchgear. (August 11th.)

Melbourne.—Victorian Railways. October 11th. Electric storage battery with accessories and spares (Cont. 35,090). October 18th. Motor generator set and static transformer (Cont. 35,089).*

September 20th. Postmaster-General's Department. Switchboard apparatus. October 17th. Automatic c.b. telephone equipment, together with all associated equipment, including apparatus for use at subscribers' premises. (See this issue.)

Victorian Railways. November 29th. Three electric storage-battery industrial trucks capable of carrying 4,000 lb. at five miles an hour.—*Reuter's Trade Service* (Melbourne).

Belgium.—August 22nd. Municipal authorities of Genappe. Establishment of a central electricity generating station on land adjoining the State railway line. M. Gilson, administrateur-délégué, Genappe.

Brighton.—September 18th. Electricity Department. Two water-tube boilers, superheater, economiser, steel chimneys, fans, feed pumps, steam pipes, valves, &c. (See this issue.)

Chile.—September 14th. Chilean State Railways. Electrical plant for the San Rosendo station. Departamento de Materiales y Almacenes. Alameda station, Santiago, Chile. Representation of the Chilian Railways at Paris, M. Bertrand, Boulevard St. Michel 33, Paris.*

Dublin.—August 24th. Electricity Department. Equipping two Babcock boilers and economiser, Pigeon House Fort, with "Vulcan" system soot-cleaning apparatus. City Electrical Engineer, Dublin.

September 1st. Post Office Stores Department, Irish Provisional Government. 4,000 ft. each casing and covers for wires and cables; 1 ton plumber's solder.

September 15th. 100,000 insulators. (See this issue.)

Edinburgh.—September 5th. Corporation. Conversion of two overhead cranes from mechanical to electrical operation. (August 4th.)

September 5th. Tramways Department. Electrical equipment for 80 electric cars. Manager, Tramways Department.

Greenock.—August 21st. Corporation. Electric lighting work in connection with the erection of 52 tenement houses. Office of Public Works, Greenock.

London.—Metropolitan Asylums Board. August 30th. Electric storage battery at the Grove Fever Hospital, Tooting Grove. (August 11th.)

H.M. Office of Works. September 5th. Supply of electrical and mechanical engineering labour in daywork in Cardiff. (August 4th.)

August 31st. Electric lighting installation at Cornwall House, S.E. (See this issue.)

Islington.—September 20th. Electricity Department. Two water-tube boilers with stokers, draught system, steel chimneys, steam piping, &c.; cooling towers, ponds, pipework, &c. (August 11th.)

Hammersmith.—September 7th. Electricity Department. Transformers, oil-cooled and air-cooled; e.h.p. cables; e.h.p. and h.p. switchgear. (See this issue.)

Manchester. — August 22nd. Tramways Committee. Permanent way points, tongues, crossings, and hardened steel centres; electrodes for welding. Mr. H. Mattinson, general manager, Corporation Tramways, 55, Piccadilly, Manchester.

August 24th. Electricity Committee. Two steel ash wagons and a lighting sling. (August 4th.)

August 31st. Electricity Committee. 420-V ironclad distribution switchgear for auxiliary services. Mr. F. E. Hughes, secretary, Electricity Department, Town Hall, Manchester.

August 31st. Electricity Committee. Supply and completion of two coal grabs. (Spec. B38.) (August 11th.)

New Zealand.—September 30th. Teviot Electric Power Board. One horizontal turbine. Francis type, coupled to a 125-kW, 3-phase, 50-cycle, 3,300-V generator; one 7.5-h.p. Pelton wheel; one 5-kW motor generator set; and complete switchboard and power station equipment.*

September 30th. Teviot Electric Power Board. One horizontal turbine, Francis type, coupled to a 125-kW, 3-phase, 50-cycle, 3,300-V generator; one 7.5-h.p. Pelton wheel; one 5-kW motor generator set; and complete switchboard and power station equipment.*

Wellington.—City Council. Erection of a large reinforced concrete power station at Shag Point.

Reigate.—August 22nd. Town Council. H.p. concentric and l.p. twin paper-insulated cable. (August 11th.)

Stockton-on-Tees.—August 31st. District Fund, Gas, and Electricity Committees. Stores, &c., for three months. (See this issue.)

St. Annes-on-Sea.—Electricity Department. 3,530 yd. .5 x .5 x .25 l.p. 3-core armoured cable; 1,460 yd. 7/22 l.p. ditto; 500 yd. .2 x .2 x .1 l.p. ditto. (See this issue.)

Tasmania.—Hobart.—October 2nd. City Council. 750-kW rotary converter and transformer and 550-volt, d.c. switchboard panel. Further particulars from the office of the Agent-General for Tasmania, Australia House, Strand, London, W.C.2.

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

India.—Cawnpore.

Riley self-cleaning multiple-retort stoker, for new boilers of Indian Electric Supply & Traction Co., Ltd.—Charles Erith & Co.

Farnham (Surrey).

Electric lighting installations at the Congregational Church and the Farnham Urban District Council offices.—C. F. Williams, Farnham.

France.—The Société Fama, of Paris, has received repeat orders for Riley stokers (selling agents in this country Messrs. Chas. Erith & Co.) for the Gennevilliers power station of the Union d'Electricité, as follows:—A fifth 36-retort stoker for Stirling boiler and two 18-retort stokers for two large B. and W. boilers. A repeat order for six 36-retort Riley stokers has also been placed by the Compagnie Parisienne de Distribution d'Electricité.

London.—Stepney.—Electricity Committee.

Extensions and alterations to Limehouse generating station (£37,370).—J. Jarvis & Sons (accepted).

Two 10,000-kW turbo-alternators and auxiliary plant at Limehouse generating station:—

	£
Richardsons, Westgarth & Co., Ltd. (a)	103,071
Ditto (b)	105,264
Ditto (c)	105,974
*Metropolitan-Vickers Electrical Co., Ltd. (a) (accepted)	107,478
†Ditto (b)	109,858
‡Brush Electrical Eng. Co., Ltd.	109,738
English Electric Co., Ltd.	116,674
Parsons, C. A., & Co. (a)	111,270
Ditto (c)	112,020
Ditto (b)	117,720
**Fraser & Chalmers	74,483
**British Thomson-Houston Co., Ltd.	77,336
**Howden, James & Co. (a)	80,645
**Ditto (b)	81,208
***Allen, W. H., & Co. (a)	18,950
***Ditto (b)	16,950
***Weir, G. & J.	20,415
***Mirrlees Watson Co., Ltd. (a)	22,807
***Ditto (b)	23,731
***Ditto (c)	23,868
***Ditto (d)	24,643
***Vickers, Ltd. (a)	23,300
***Ditto (b)	23,200
***Hick, Hargreaves & Co., Ltd. (a)	24,416
***Ditto (b)	26,740
***Worthington-Simpson, Ltd.	24,809
***Cole, Marchent & Morley, Ltd.	28,839
††Reyrolle, A., & Co., Ltd.	3,538

* Can be reduced by £1,110 for spares, if not needed. † Can be reduced by £1,024 for spares, if not needed.
‡ Cannot complete first set under two years and second set under two years and nine months.
** Excluding condensing plant.
*** Condensing plant only. †† Switchgear only.

Acting on the recommendation of the Borough Electrical Engineer and Manager, the Committee has accepted the tender "(a)" of the Metropolitan-Vickers Electrical Co., Ltd., at £107,478, which, in the event of the spares not being required, will be reduced by £1,119.

Meters and combined meters and demand indicators for the period ending June 30th, 1923:—

The Committee recommends acceptance of the tenders of the Aron Electricity Meters, Ltd., for combined meters and demand indicators; Ferranti, Ltd., for meters (50 and 100 amps. capacity); and Reason Manufacturing Co., Ltd., for meters (2½ to 20 amps. capacity).

One mile each "C" and "D" troughs and covers (£495).—Sutton and Co. (Overseal), Ltd. (Accepted.)

Fifty tons moulded pitch (£231).—Crow, Catchpole & Co., Ltd. (Accepted.)

Coal for the Limehouse generating station:—

5,000 tons of Scotch washed pea nuts (22s. 6d. per ton).—J. Hudson and Co., Ltd. 5,000 tons of Scotch washed peas (21s. 5d. per ton).—W. Cory & Son, Ltd. 3,000 tons of Littleton 1¼-in. nutty slack (21s. 3d. per ton).—E. Foster & Co. 5,000 tons of Pinxton slack and/or Selston ¾ in. to ¾ in. (19s. per ton).—Milner, Thomas & Co., Ltd. (Accepted.)

Lanarkshire.—County Council. Accepted:—

Electric lighting work at the County Hall, Hamilton (£372).—Malcolm and Allan.

Luton.

Two Riley self-cleaning multiple-retort stokers, for new boilers at electricity works.—Charles Erith & Co.

Maidstone.—Installation of electrically-driven pumps, motors, wiring, &c., at Barming Heath Mental Hospital.

G. E. Taylor & Co. (accepted)	**£760**
Sleigh & Wood	867
Beaven & Sons	912
V. G. Middleton	916
Ellis & Ward, Ltd.	957
T. Clarke & Co., Ltd.	969
Cecil Cooper & Co., Ltd.	1,028
W. Weeks & Sons, Ltd.	1,075
Oswald Jones & Co.	1,100
Drake & Fletcher	1,103
Crompton & Co.	1,130
Marryat & Place	1,165
Francis Polden & Sons	1,258
Commercial Telephone & Electrical Co.	1,336

Rathmines.—Urban District Council. Accepted:—

Two 200-kW Bruce Peebles-La Cour motor converters and switchgear.—R. N. Eaton & Co., of Dublin.

Southend-on-Sea.—Education Committee. Accepted:—

Installing electric lighting at the Education Offices.—Fogden & Barnes.

Torquay.—Town Council. Accepted:—

3,000-kW turbo-alternator.—British Thomson-Houston Co., Ltd.
Condensing plant.—Cole, Marchent & Morley.

NOTES.

Electrical Installations in British Malaya.—From the annual report of Mr. G. E. Greig, Acting Senior Warden of Mines, Federated Malay States, it appears that there was an increase in the number of installations of electrical plant in the Federated Malay States in 1921. Although the ordinary installations show a falling-off from 110 in 1920 to 101 in 1921, there were in addition 78 self-contained low-voltage lighting plants at work in private houses, &c., as against 45 in 1920. The aggregate kilowatt power of motors of all installations increased from 12,155 in 1919 and 13,117 in 1920 to 14,724 in 1921. A classification of all electrical generating plant employed in the Federated Malay States in 1921 is given in kilowatts as follows:—

	Power.	Other Plant.
Mining	11,000	316
Agriculture	70	268
General	108	156
Government	331	2,475
	11,509	3,215

The increase in general capacity is all the more remarkable in view of the depressed conditions prevailing in most industries during the past year. Mr. Greig reports that the standard of efficiency among the natives in charge and wiremen was low. Suitably-qualified engineers were difficult to obtain owing, no doubt, to the difference between the salary offered and the qualifications demanded by the local enactments.

Dundee Appointment.—The number of candidates is 86 for the Dundee appointment. A short list of seven of these has been selected.

Proposed Service Subways for Manchester.—The special sub-committee of the City Council appointed to deal with the question of subways for the conveyance of cables, gas and water mains, &c., met on August 4th. A report on the subject was presented by the City Engineer. It was stated that the cost of constructing a subway in Mosley Street and the reconstruction of the sewers, &c., would be about £75,000. A further £28,000 would be required to effect the removal of existing cables and pipes into the subway. It is considered that the cost of maintenance would be about the same, but the system would have the advantage of obviating the breaking-up of roads, although this advantage would only be gained by a large capital outlay. The report estimates that the average cost per mile of subway in new streets would be £140,000. The sub-committee, which is composed of members of the electricity, water, gas, and other committees, decided to call for more information before taking any further steps.

Ireland's Power Resources.—Mr. L. J. Kettle, the Dublin city electrical engineer, speaking at a recent meeting of the Dublin Rotary Club, said that Ireland's peat deposits would last for another 250 years, but the water power constituted a permanent source of energy. He warned his audience that the coal supplies were liable to be cut off at any moment. The water resources provided a means of obtaining cheap power, which should be developed at once.

The s.s. Bendigo.—The s.s. *Bendigo*, a large twin-screw steamer of 13,100 tons, built by Messrs. Harland & Wolff, Ltd., to the order of the Peninsular & Oriental Steam Navigation Co., Ltd., for its Australian pasenger service, has just been handed over after satisfactory trials on the Clyde. Needless to say, electricity is used largely on the ship. The electrical installation consists of four main generators and one vertical oil engine-driven dynamo situated well above the water-line. All the water-tight doors, which are electrically operated, can be closed simultaneously from the captain's bridge. The ship's whistle is operated electrically from the bridge. The electrically-driven gear includes large fans for the boilers, also refrigerating and ventilation fans. The two hoists for the pantry and a dough mixer, dish washer, and potato peeler are electrically operated. Loud-speaking telephones have been installed to assist navigation, and there are considerably over 1,000 electric lights and 70 motors in the ship.

Electricity from the Earth?—A French engineer, M. Jules Guillot, claims to have produced a static transformer with which he can make use of earth currents in a practical way. M. Guillot is said to have been at work for some years on his apparatus, by means of which he hopes to collect electricity from the earth in a form suitable for general use.—*Daily Mail.*

American Railway Electrification.—In the course of an address delivered before the Connecticut Section of the A.I.E.E. Mr. Calvert Townley, of the Westinghouse Electric and Manufacturing Co., of New York, said that it was generally admitted that all railway electrification in the U.S.A. had been successful, but he pointed out that not more than about one per cent. of the entire steam railroad mileage of the United States had been electrified as yet, and the average railroad executive might be excused if he looked upon the existing examples as special cases and, therefore, as proving nothing with respect to his own particular problem. For example, the New Haven and the New York Central Railway had to electrify its lines out of New York because of a law passed by the State of New York. The Pennsylvania Co. had to electrify its road out of New York City in order to operate its subway river tunnels. The Norfolk & Western Railway had a peculiar "restricted neck to its bottle" in the Elkhorn grades which would justify almost any expense to remove. In a like manner some special reason could be found for almost every large electrification project. However, it was perfectly safe to say that the attitude of mind of the railroad man had materially changed so that the question always first asked some years ago, "Can it be done?" had now been replaced by the entirely different question, "Will it pay?"

Swiss Water Power.—The *Financial Times* recently published an article from a Berne correspondent upon the position of the Swiss hydro-electric industry as at December 31st, 1920. There were 178 stations of 500 h.p. capacity or over built or actually under construction. These had a minimum rating of 439,962 h.p. in the aggregate, and a maximum of 1,687,121 h.p. The yearly production of energy was 3,930,450,000 kWh.

At the end of 1921 there existed official sanctions for the export of 236,067 kW, as follows:—To France, 153,231; to Italy, 56,826; to Germany, 26,010 kW. The largest hydro-electric station in Switzerland is that at Wäggethal, which is not yet finished; this will eventually have a plant capacity of 140,000 h.p. The Amsteg station of 85,800 h.p. is also not yet completed. The largest finished station is at Olten-Gösgen (80,000 h.p.) and there are eight other stations developing over 50,000 h.p. In addition to these large undertakings there are probably six or seven thousand smaller private installations.

Blast-furnace Gas.—Mr. N. H. Gellert points out in an article in the American technical Press that the value of clean blast-furnace gas as against dirty or raw gas for use in blast-furnace stoves or under boilers has been so well demonstrated as to cause the largest and most progressive steel producers to spend millions of dollars in installing gas-cleaning plant. From 48 to 50 per cent. of the thermal value of the coke charged into a blast furnace issues from it in the form of latent and sensible heat of combustible gas; 30 per cent. of the gas generated is used to increase the temperature of the blast, while 60 per cent. of it is burned under boilers or consumed in gas engines. Now if it be conceded that clean gas is to be preferred there remains the question: Shall it be cleaned by a wet or dry process? From the author's discussion of the heat values of gases cleaned by both methods it appears that dry-cleaned gas at 400 deg. F., even if it contains 35 grains of moisture per cu .ft., has a greater available heat value than wet-cleaned gas at 70 deg. F., which only contains 7.98 grains of moisture per cu. ft. This heat is 6.5 per cent. greater for the former gas than for the latter. At six dollars per ton for coke charged into the furnace it means a saving of 0.156 dollar per ton of iron made in favour of using hot cleaned gas. There is no difference in the flame temperatures of the two gases.

French Water Power.—The development of the water resources of the Alps was the subject of a recent address, by M. Ducrest, before the Société Scientifique de l'Isère. He said that the remedies for seasonal and daily fluctuations in water-power undertakings were, on the one hand, the improvement and extension of the big distribution networks; and, on the other hand, the erection of great complementary generating stations, whose effect would be the regulation of production and the obviation of insufficient seasonal and yearly supplies. Such generating stations should be hydraulic on account of lower cost, and the reservoirs supplying them should be of moderate size, but situated at great heights, or of larger size if situated at lower altitudes. The Alpine regions were specially suited for such reservoirs owing to the torrents from the upper glacial districts. Passing in review a number of reservoir schemes under way in the neighbourhood of Grenoble, the lecturer indicated the many lakes in the Belledonne range which must eventually be harnessed. Two other big schemes lately projected were the Chambon dam on the Romanche and the development of the Laffrey lakes. But while the Chambon dam would benefit existing stations on the Romanche only, the Laffrey scheme would favour the construction of a complementary station meeting, not only the needs of existing consumers, but also future demands. The lecturer concluded by advising the appointment of a committee to study questions of such vital importance to the region at large.

Standard Rates for Battery Hire and Charging.—The motor traders and garage owners in the Dublin district have recently adopted a series of standard charges for recharging batteries used on petrol motor vehicles as follows:—

	Acid and First Charge.	Ordinary Charge.
	s. d.	s. d.
4 and 6 volts, over 20 and up to 40 Ah. ...	4 6	2 0
4 and 6 volts, over 40 and up to 80 Ah. ...	7 0	3 6
4 and 6 volts, over 80 and up to 100 Ah.	9 0	5 0
6 and 12-volt lighting and starting batteries	12 6	7 6

A standard charge of 2s. 6d. for the first day and 1s. per day afterwards has also been adopted as regards the hiring of batteries.

A New Profession.—Amongst the "situations vacant" announced in this issue is one which we hail with interest and pleasure as the very first of its kind—an opening for a farmer to become an electrician, or an electrician to become a farmer. The progress of the application of electricity to farming is slower than we could wish, but progress is being made; the work which Mr. R. Borlase Matthews has already accomplished in this direction will go far towards hastening its development, and we should think that there will be a large number of candidates for initiation into the mysteries of this combination of nature and science.

"Greater London."—The area known as London extends into a number of counties, but it was left to our American contemporary *Electric Traction* to draw our attention to suburban Lancashire. It states: "The new Preston Motor Omnibus service, between the Town Hall and Lytham Road in London seem (*sic*) to have made an auspicious start. In February they carried 68,885 passengers. Total receipts for the month were £537 and the buses earned 24.04d. per bus mile, as compared with 18.08d. per car mile from the tramways. This is certainly a fine showing and would clearly indicate that Londoners in the tributary territory covered by the Preston line have felt the need of the new enterprise." An illustration of an omnibus labelled "Preston Corporation" accompanies the note. This precludes the assumption that the last L.C.C. (Tramways and Improvements) Act embodied the provision of a "Preston Line."

Appointments Vacant.—Professor of Electrical Technology, in the Indian Institute of Science, Bangalore. (Rs.1,500 per mensem); Draughtsman and Clerk of Works (temporary), for the Torquay Electricity Department; Junior Assistant Engineer (300 to 350 taels per month), and three Exchange Managers (clerks in charge) (300 to 350 taels per month), for the Shanghai Mutual Telephone Co., Ltd. Tael=3s.; Teacher of Electrical Engineering for the St. Helens Education Committee; two Electricians (£420 each) for the Nigerian Government Railway; Junior Shift Engineer for the Fulham B.C. Electricity Department. (See our advertisement columns to-day.)

Indian Telephone System.—Great developments are expected in India within a short time in connection with the telephone system. New lines are under construction and others are projected. The telephone branch of the Department of Posts and Telegraphs has now been considerably strengthened and a special officer has been appointed to deal with the telephone projects of the Government, under the chief engineer of the telegraphs. A scheme of establishing telephonic communication between Calcutta and Bombay is being considered. "It is proposed to use the existing copper telegraph lines by means of coils for telephonic purposes." There are already a number of telephone lines worked on the automatic system in existence. Communication is now possible between Simla and Lahore, Lahore and Rawalpindi, Rawalpindi and Peshawar, Lahore and Delhi, Lucknow and Cawnpore, Lucknow and Allahabad, Calcutta and Asansol, Asansol and Leyabad, Bombay and Poona, Poona and Mahableshwar, Bombay and Surat, Surat and Broach, and Broach and Ahmedabad. To link up the Punjab system directly with the United Provinces system the line between Delhi and Bareilly has recently been completed and the line from Delhi to Agra is about to be completed. The Delhi-Bareilly line provides means of communication between Delhi, Lucknow and Allahabad. When repeaters are installed it will be possible to speak from Lahore to Peshawar and from Simla to Lucknow and Allahabad. In the Bombay Presidency the telephone branch of the Department of Posts and Telegraphs intends to open a telephone system at Sholapur and establish communication between Poona and Sholapur. It is proposed to close down the Government telephone exchanges in Calcutta and Bombay and give the companies serving the public in these cities the option of purchasing the Government apparatus at a reasonable price. The Bengal Telephone Co., Ltd., will then take over the entire system in Calcutta. The Bombay Telephone Co. proposes to adopt the automatic system, as it is experiencing considerable difficulty in securing operators. When the telephone systems between Madras and Ootacamund and Madras and Bangalore and Conoor are completed they will be of the relay automatic type. The system between Simla and Lahore is automatic, and the Cawnpore system is a modified Strowger system. Ganeshkhind has also the relay automatic system. In connection with the establishment of long-distance telephones in India, it is mentioned that between Simla and Delhi, Rawalpindi and Murree, Asansol and Loyabad, Bombay and Poona, and Bombay and Surat, there are now three speaking lines (two physical lines with one phantom). Between Broach and Ahmedabad there is at present one speaking line, but another physical and one phantom are to be laid this year, providing three speaking lines. Between Calcutta and Asansol there are three physical and one phantom lines, giving four speaking lines. The others are single speaking lines.—*Financier.*

Roller Bearings for Railway Trains.—A new roller bearing for railway coaches which, it is anticipated, will lead to economies in running costs, has recently passed its preliminary trials on the Great Eastern Railway. The new bearing is the patent of the Chain Roller-Bearing Co., Ltd., of Birmingham. It is said that over 60 years ago a train was fitted with bearings having brass rollers by the Eastern Counties Railway (now the G.E.R.). Also about 20 years ago similar tests were made with roller bearings consisting of hard solid steel rollers controlled by a revolving cage. These tests were made on the London, Brighton & South Coast and the South-Eastern Railways, with most satisfactory results. Later trials were made by the Great Western, North-Eastern, Caledonian, and several of the London Underground electric railways, with corresponding success. For upwards of fifteen years roller bearings have been used in India.

Educational.—Huddersfield.—Under the Huddersfield Education Committee a class in wireless telegraphy and telephony is to be established at the municipal Technical College, provided there is a minimum of fifteen students.

United States Electric Vehicle Market.—Business in the truck division of the electrical vehicle market during July was fairly good. Department stores in the metropolitan district recently placed orders for 20 additional trucks. There is only one department store now in New York which is not using electric trucks, but it is intended to substitute electric for gas vehicles when the concern moves to its new store which is now being erected. A Brooklyn baking company recently placed an order for 30 electric trucks and a Newark (New Jersey) baking concern, which now owns 12 trucks, has arranged to increase its fleet to a total of fifty. Messrs. Rauch & Land, Inc., manufacturers of electric passenger automobiles and industrial trucks, have sold eight electric taxicabs for operation in New York. They will be placed in operation on September 15th, and if the taxis are as successful as anticipated the purchaser proposes to augment the fleet. The trade generally is greatly interested in the plan to introduce electric taxicabs in New York, where it is believed they will prove very popular. Electric taxicabs are widely used in Chicago, Detroit, and other western cities, and in the opinion of local traction experts there would appear to be no reason why they should not be equally popular in New York City. The annual Electric Industrial Exposition will be held in New York from October 7th to 14th. Manufacturers of trucks and other electric vehicles are preparing to stage an exhibit of record proportions at the show. Twenty-six electric trucks and passenger cars, valued at $27,235, were exported from the United States during May.—*Reuter's Trade Service* (New York).

The Wimbledon Case.—It is reported that an action brought against the Wimbledon Corporation for wrongful dismissal by Mr. H. Tomlinson-Lee, late chief electrical engineer, has been decided in favour of the latter. The Town Council paid into Court a further two months' salary, making six months in all, and did not attempt to justify its action; the Council will also have to pay the costs of both sides, which amount to a considerable sum.

Aluminium Field Coils.—*Electric Traction* states that since the commencement of operations in Kansas City a year ago a firm of traction motor manufacturers has supplied 500 sets of aluminium field coils. These are of square section, and are formed before a special oxidisation process is applied to them. This process gives the metal a heat- and moisture-resisting coating. After oxidisation the coils are dipped in insulating varnish, taped, dipped, and baked. The terminals are of copper or brass, soldered with a special compound, which prevents electrolytic action. The weight of these aluminium coils is said to be only from 25 to 50 per cent. of that of equivalent copper coils. The use of aluminium for magnet coils was dealt with at some length in our issue of December 5th, 1913.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Mr. J. A. Hartigan has resigned his position as manager of the fan and small motor department of Messrs. S. G. Leach & Co., Ltd., and has been appointed sales manager for London and South of England for the Triumph Electric Manufacturing Co., Ltd., electric fan manufacturers, Birmingham, who have opened offices and showrooms at 58, High Street, Bloomsbury, W.C.2. Telephone: Gerrard 5070.

Rumours having been current regarding the serious accident which lately happened to Dr. Boveri, chairman of Brown Boveri & Cie., of Baden, our readers will be interested in hearing the facts. While on a motor trip to Holland, where he intended to spend his holidays, Dr. Boveri met with a serious accident. Owing to a defect in the car, the latter overturned and rolled down a slope about 13 ft. deep. Dr. Boveri sustained a broken leg and a dislocated shoulder, while Mrs. Boveri, who accompanied him, had a wrist broken and suffered some contusions which, however, are not dangerous. Dr. and Mrs. Boveri are now in the St. Willibrordus Hospital, at Emmerich, on the Rhine, which fortunately is close to the scene of the accident, and the condition of both is as satisfactory as can be expected.

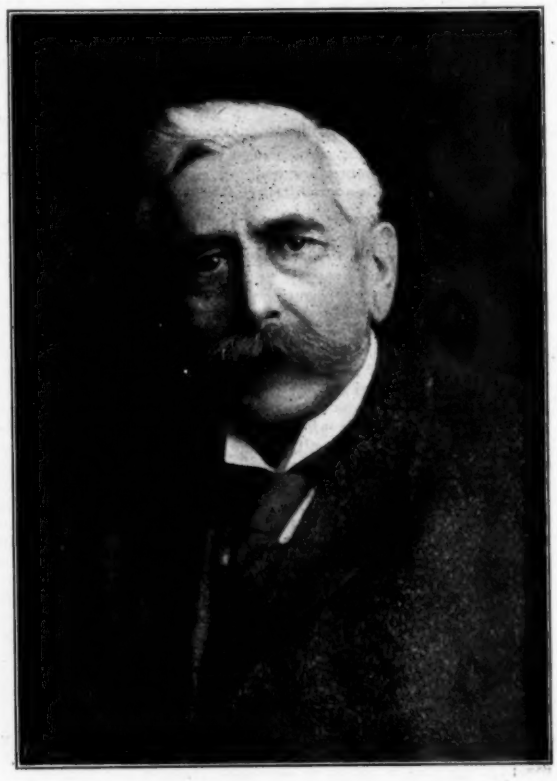
Mr. D. G. Davies, B.Sc., who has for some time occupied the position of resident engineer at the Motherwell power station of the Clyde Valley Electrical Power Co., has been appointed to the position of executive engineer to the Port of London Authority.

Mr. J. R. Blaikie has been presented with an antique Persian rug by the staff and employés of the Bedford electricity department on leaving the service of the Corporation. Mr. Blaikie was engaged as consulting engineer at the Bedford works during the absence of the borough electrical engineer with the Royal Air Force. The extensions were carried out in two stages, the first to meet urgent war demands, and the second, recently completed, to provide up-to-date plant with suitable reserves.

Mr. E. N. Bray has severed his connection with Messrs. Bray, Markham & Reiss, Ltd., and with the Electrical Apparatus Co., with whom they were amalgamated. He has purchased a small works, Whipps Cross Works, Wood Street, Walthamstow, London, E.17, where he intends to manufacture certain types of switchgear. A number of his old staff are with him, and some of them are directors of the new company.

Obituary.—Dr. Gisbert Kapp.—We regret to record the death of Dr. Gisbert Kapp at his home at Selly Park, Birmingham, on the 10th inst. This makes another gap in the ranks of the pioneers of the electrical industry. Dr. Kapp was a most successful designer of electrical machinery, and the original work he did in the early eighties was freely described by him at the time. He was a clear thinker, and the help he so freely gave to others enabled them to follow his success in this direction.

Dr. Kapp was born at Mauer, near Vienna, in 1852. He received his technical training in mechanical engineering at the Zurich Polytechnical School, under Zeuner and Kohlrausch. He came to England in 1875 and spent most of his life in this country. At first he was engaged in the design of centrifugal pumping plant for Messrs. Gwynne & Co., and he then spent some time as the engineering representative of Messrs. Hornsby on the Continent.



Elliott & Fry] [*London.*

The Late Dr. Gisbert Kapp.

Dr. Kapp from the first took a keen interest in electrical machinery, but it was not until 1882 that he became directly connected with the electrical side of the engineering profession. In that year Col. Crompton appointed him engineer of his Chelmsford works. This connection, which lasted until 1885, was most fruitful in the development of dynamo design. If one looks back on the dynamos that were then being manufactured and which were exhibited in the Electrical Exhibition in Paris, of 1881, it will be seen that they were all more or less pieces of scientific apparatus. They were deficient mechanically, but the biggest fault lay in the design of the magnetic circuit.

Dr. Kapp introduced many improvements in this direction, and what was more important instructed other electrical engineers in the essentials in the design of the magnetic circuit of a dynamo. The term "magnetic resistance" introduced by him made the magnetic circuit simple to understand, and the methods of calculation he disclosed were almost universally adopted.

In 1885, his paper presented to the Institution of Civil Engineers on "Modern Dynamos and their Engines" was awarded the Telford Premium and Medal.

In 1886 he published his first book on "Electric Transmission of Energy," which is now historic. It is as interesting to read to-day as when it was first issued. In it the author did much to clear away the uncertainty and mystery with which the general public and many engineers also then regarded electrical engineering. To quote from the preface of this book: "We know that practical success does not so much depend on the system as on the men who plan and carry out electrical work, and the less of a special system and the more of general good engineering there is the better. Many of the general public and even many of our professional brethren regard electrical engineering especially as applied to the transmission of energy as something uncertain, mysterious and, as yet, in the experimental stage. It has been the aim of the author to dispel this impression by presenting the scientific part of the subject in as simple a form as possible and by giving descriptions of work actually carried out."

This book and Dr. Kapp's early papers were certainly successful in this direction, and did more than any contemporary works to enable the ordinary engineer to make sound progress in the subjects dealt with.

From 1886 to 1889 Dr. Kapp was the editor of *Industries*. In 1889 he introduced the multipolar type of direct current dynamo. The first machines of this type were installed in the municipal electricity works at St. Pancras. In spite of their cast-iron field systems they were a success.

It is difficult now to realise how strongly this type of machine was decried by the other designers who adhered to the bi-polar type. Dr. Kapp was then practising as consulting engineer in Westminster, and was responsible for some large undertakings, both at home and abroad. He designed the first Corporation electricity works at Bristol, acting as joint consulting engineer to the Corporation, with the late Sir W. H. Preece.

In 1894 Dr. Kapp was appointed Secretary of the Verband Deutscher Elektrotechniker which was formed by the leading German engineers with the object of standardising electric practice throughout the German Empire. At the same time he acted as editor of the *Elektrotechnische Zeitschrift*.

The next ten years were spent in Berlin. Both high technical skill and power of organisation were needed to produce the series of standard specifications which were issued by the Society with respect to the rating of dynamos, lamps, copper conductors, wiring rules, &c., &c. During this period, Dr. Kapp lectured on electrical design at the Technical High School, Charlottenburg, and the Universities of Dresden and Karlsruhe, both conferred on him their Honorary Degrees of Doctor of Engineering.

In addition to the above responsibilities Dr. Kapp practised as consulting engineer, and his services both as arbitrator and designer of schemes for power, lighting, and traction were widely sought. Thus, Moscow, Trondhjem, Trieste and Leipzig are amongst the towns he advised, and he had an extensive practice in Switzerland and Italy.

In 1905 the University of Birmingham organised a Professorship of Electrical Engineering which was accepted by Dr. Kapp. This he filled with great success until 1918, and a large number of students passing through the University owe their technical training to him.

Dr. Kapp filled many offices with the Institution of Electrical Engineers, and was president in 1910. His contributions to the proceedings were always highly valued.

The Patent Office records are an eloquent testimony to his originality, but the patents issued while numerous show the same thoroughness which characterised all his work. The subject matter in the early days was mostly connected with dynamos and alternator design. Then transformers claimed his attention and patents followed on metering of electricity, negative boosters for tramway return systems, regenerative control for long feeders, signalling, &c., &c. His latest inventions were for improving the power factor of alternating current systems by means of phase advancers, which have been largely adopted.

His appreciation of the work of others and the critical analysis of this for his students made his lectures always interesting. He had the power of separating out the essentials of any particular process and his conclusions were always clear and illuminating. A hard worker himself he had no use for the idler, but there were very few who did not catch from him enthusiasm for the subject under consideration. He led his students to undertake original investigation, and helped them freely in their professional careers.

Dr. Kapp's many friends will miss his kindly hospitality and the evening talks when politics were by no means barred. He was an ardent free-trader and enjoyed always the freedom of opinion possible in this country.

His recreations were sailing, golf, and music. Dr. Kapp in 1884 married Therese Mary Krall, and had two sons, both of whom have followed in their father's profession.—R.W.W.

The funeral of Dr. Kapp took place on Saturday, at the Birmingham Crematorium, Perry Barr. The chief mourners were his sons—Mr. Reginald Kapp, and Mr. Norman Kapp.

Councillor Thomas Pratt.—The death occurred, on August 14th, at the age of 67, of Councillor Thomas Pratt, ex-president of the National Chamber of Trade, and governing director of the firm of Christopher Pratt & Sons, Ltd., electrical contractors and house furnishers, Bradford. Mr. Pratt was the second son of the founder of the firm.

Councillor Pratt was one of the founders of the Bradford Chamber of Trade, in 1903, and was its president in 1910. He was president of the West Yorkshire Federated Chambers of Trade in 1914, and president of the National Chamber of Trade in 1918 and 1919. He entered the Bradford City Council in 1920. During, and since, the war he served in many capacities. He was a member of the Board of Trade Advisory Committee on Road Transport for the North-Eastern Division; the Board of Trade Advisory Committee on Merchandise Marks; the Ministry of Labour Advisory Committee for the Distributive Trades on Disabled Sailors and Soldiers, and many other organisations.

Sir Albert K. Rollit.—We regret to record that Sir A. K. Rollit passed away on Saturday last, at the age of 80 years. Though latterly Sir Albert had not been so prominently associated with affairs in the City of London, he was in earlier years most actively engaged as a president of the London Chamber of Commerce, and of the Associated Chambers of Commerce of the United Kingdom. He was a director of the National Telephone Co., Ltd., and figured prominently in the meetings in the City which preceded the taking over of that company by the Government.

Mr. F. F. Talbot.—The *Railway Engineer* records the death in his 78th year, of Mr. Frank Forrest Talbot, who was for many years Telegraph Superintendent of the Central Argentine Railway. "A member of the Institution of Electrical Engineers, Mr. Talbot went out in 1864 under contract for the construction, organisation and superintendence of the telegraph and signalling of the Northern Railway of Buenos Ayres, and in 1868 took a contract with Brassey, Wythes & Wheelwright for the construction, installation, organisation and working of the telegraph system, lighting, &c., of the Central Argentine Railway (then commenced from Rosario northwards), and with which the Northern Railway was subsequently amalgamated. He continued with the Central Argentine Railway until 1905, when he retired on pension."

Will.—The late Dr. J. T. Merz left £18,980 gross and £18,835 net personalty.

NEW COMPANIES REGISTERED.

Butterworth & Co. (Glasgow), Ltd. (8,315).—Private company. Registered in Edinburgh August 1st. Capital, £2,500 in £1 shares. To carry on the business of armature winding and general repairers of all kinds of electrical apparatus, electrical contractors, engineers, &c. The subscribers (each with 100 shares) are:—C. J. Butterworth, "Auchenmede," Bishopton, electrical engineer; B. J. Graham, 21, Galloway Street, Springburn, Glasgow, electrical engineer; Mrs. Mabel Butterworth, "Auchenmede," Bishopton. The first directors are not named. Solicitors: Black, McClure and MacDonald, 136, Wellington Street, Glasgow.

Pyne Manufacturing Co., Ltd. (183,570).—Private company. Registered August 3rd. Capital, £2,000 in £1 shares (500 pref.). To adopt an agreement with H. D. Pyne and others for the acquisition of the business of an electrical and general engineer and manufacturer carried on at Latimer Road, Teddington, Middlesex. The first directors are:—H. D. Pyne (permanent managing director and chairman), 41, Winchenden Road, Teddington; Mrs. Edith E. Pyne, 41, Winchenden Road, Teddington. Qualification, 50 shares. Registered office, Latimer Road, Teddington, Middlesex.

Hartnell Hiring Co., Ltd. (183,508).—Private company. Registered August 1st. Capital, £6,000 in 4,000 10 per cent. participating pref. shares of £1 each and 8,000 ordinary shares of 5s. each. To carry on the business of electrical and mechanical engineers, electricians, manufacturers of, and dealers in, electrical machinery, motors, dynamos, generators, and apparatus, &c. The life directors are:—R. D. Fairclough, 8, Park Road, Dewsbury (chairman); W. D. Oddy, 47, Gledhow Wood Grove, Leeds (both directors Wilson Hartnell & Co., Ltd.). Qualification, £200. Registered office, 11, New Station Street, Leeds.

Radio Appliances, Ltd. (183,571).—Private company. Registered August 3rd. Capital, £1,500 in £1 shares. To carry on the business of manufacturers of, agents for, and dealers in, all kinds of wireless and electrical apparatus, &c. The permanent directors are:—S. M. Travers, 55, Beechwood Avenue, Thornton Heath; F. Hart, 211, Camden Road, N.W.1. Remuneration, £50 each per annum. Registered office, 68, Coleman Street, E.C. 2.

Pickvance, Ltd. (183,595).—Private company. Registered August 4th. Capital £5,000, in £1 shares (3,000 ord. and 2,000 pref.). To acquire the business carried on by W. H. Pickvance, at 41a, Regent Street, Wrexham, and to carry on the business of electrical engineering in all its branches. The first directors are: W. G. Pickvance, 61, Ruabon Road, Wrexham, engineer (chairman); Mrs. M. Pickvance, 61, Ruabon Road, Wrexham. W. G. Pickvance is permanent managing director subject to holding £200 ord. shares, with not more than £350 per annum as remuneration, together with 30 per cent. of the available profits in excess of 10 per cent. dividend paid on the ord. shares. Solicitor: W. B. Esam, 29, Bank Street, Sheffield.

Almondsbury and District Electric Supply Co., Ltd. (183,582).—Private company. Registered August 4th. Capital, £3,000 in £1 shares. To carry on at Almondsbury, Glos., and elsewhere, the business of an electric light and supply company. The permanent directors are:—W. D. Goodenough, 62, Hampton Road, Redland, Bristol; C. J. T. Tanner, 27, Ravenswood Road, Redland, Bristol. Qualification, £25. Remuneration as fixed by the company. Registered office: 62, Hampton Road, Redland, Bristol.

Hull Wireless Co., Ltd. (183,624).—Private company. Registered August 8th. Capital £500, in £1 shares. To carry on the business of manufacturers of, agents for, and dealers in instruments, apparatus, and accessories used in connection with radio or wireless telegraphy and telephony, &c. The first directors are:—Mrs. F. H. Jones, 291, Beverley Road, Hull (permanent director and chairman); R. H. Moseley, 48, Havelock Crescent, Bridlington, E. Yorks. Registered office: 6, Wright Street, Hull.

George F. Sugden & Co., Ltd. (183,588).—Private company. Registered August 4th. Capital £5,000, in £1 shares. To carry on the business of electrical engineers, telegraphy, telephony, radio-telegraphy and radio-telephony, boiler, mechanical, motor, motor transport, agricultural, civil, constructional, metallurgical, marine, naval, aircraft, armour and defence engineers, &c. The life directors are:—P. S. Brook (chairman), 13, Curzon Park, Chester (director of Brook, Hirst & Co., Ltd.); G. F. Sugden, 38, Queen Street, Chester (director of Vaudrey, Ltd.); J. T. de Seyfried, 86, Watergate Flags, Chester. The above directors may appoint two of their number to be managing directors, with not more than £400 each per annum as remuneration. Qualification £200. Remuneration (except managing directors) as fixed by the company. Secretary: G. F. Sugden. Registered office: 9, Albert Square, Manchester.

Knighton Electric Supply Co., Ltd. (183,594).—Private company. Registered August 4th. Capital £6,000, in £1 shares. To carry on the business of an electric light and power supply company, &c. The permanent directors are:—H. J. Clee, 1, Broad Street, Knighton, Radnorshire; H. J. Brokensha, Red Lion Hotel, Knighton, Radnorshire; Dr. J. A. K. Griffiths, Wylcwm House, Knighton, Radnorshire; G. M. Perkins, 6, High Street, Knighton, Radnorshire; J. Atkins, 1, Thames Avenue, Windsor, Berks. Qualification £100. Secretary: P. Parker. Registered office: 6, Broad Street, Knighton, Radnor.

Scottish Wireless Telephone Supplies, Ltd. (12,320).—Private company. Registered August 3rd. Capital £1,500, in £1 shares. To manufacture, buy, and sell apparatus appertaining to wireless installations (telephonic or telegraphic), &c. The first directors are:—J. A. Brockie, 72, Forest Avenue, Aberdeen, electrician; A. Brockie, 79, Salisbury Place, Aberdeen, manager; J. Johnston, 49, Hamilton Place, Aberdeen, advocate. Registered office: 82, Crown Street, Aberdeen.

W. & J. Jamieson, Ltd. (12,325).—Private company. Registered in Edinburgh August 5th. Capital £1,000, in £1 shares. To carry on the business of scientific instrument makers, model and electrical engineers, &c. The subscribers (each with one share) are:—J. Jamieson, 68, Shamrock Street, W. Glasgow, scientific instrument maker; William Craig, 68, Shamrock Street, W. Glasgow, scientific instrument maker; R. Harley, 4, Woodburn Place, Glasgow, clerk. The first directors are:—J. Jamieson, W. Craig, and R. Harley. Solicitors: D. & J. Hill. Registered by J. Rankin, 138, West Regent Street, Glasgow.

South Wales Wireless Installation Co., Ltd. (183,686).—Private company. Registered August 10th. Capital £2,000, in £1 shares. To carry on business as indicated by the title. The first directors are:—Lt.-Col. J. Evans, D.S.O., T.D., J.P., Beaumont, Blackwood, Mon.; A. W. Jesseman, 52, Upper Belgrave Road, Bristol; G. Bell, 53, Commercial Street, Newport, Mon.; H. M. Twist, 31, Somerset Road, Newport, Mon.; J. J. Dixon, 11, Dyfrig Road, Cardiff; C. W. Liles, 52, York Place, Newport, Mon. Qualification £100. Secretary: W. H. Liles. Registered office: 18, West Bute Street, Cardiff.

Exceloid Co., Ltd. (183,587).—Private company. Registered August 4th. Capital £1,000, in £1 shares. To carry on the business of manufacturers of, and wholesale and retail dealers in, a preparation styled "Exceloid" for covering electrical, surgical and other instruments, golf balls, motor car appliances, &c. The permanent directors are:—B. D. Baker, Victoria Road, Cleveleys; J. D. Birnie (no address given); W. S. Birnie (no address given); W. Birnie, 162, Kelvinside, Derbyshire Lane, Stretford. Qualification, £50. Remuneration as fixed by the company. Secretary: C. D. Harrison. Registered office: 34, Birley Street, Blackpool.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

D.P. Battery Co., Ltd. (44,084).—Return dated July 20th, 1922. Capital £100,000, in £1 shares. All shares taken up; £28,000 paid; £72,000 considered as paid. Mortgages and charges: Nil.

Chamberlain & Hookham, Ltd. (59,920).—Return dated June 13th, 1922. Capital £100,000, in 10,500 ord. and 9,500 pref. shares of £5 each. 10,100 ord. and 8,000 pref. shares taken up; £36,990 paid on 100 ord. and 7,298 pref.; £53,510 considered as paid on 10,000 ord. and 702 pref. Mortgages and charges: Nil.

Sunderland District Electric Tramways, Ltd. (79,054).—Return dated February 28th, 1922. Capital £151,012, in 4,505 non-cum. 6 per cent. pref. shares of £1 each, 95,495 non-cum. 12 per cent. pref. shares of 10s. each, 95,010 ord. shares of £1 each, and 74,990 ord. shares of 1s. each. 95,495 pref. and 74,990 ord. shares taken up; 10s. per share called up on the pref., and 1s. per share on the ord.; £51,497 paid. Mortgages and charges: £221,315 19s. 2d.

Penarth Electric Lighting Co., Ltd. (52,912).—Return dated June 22nd, 1922. Capital £50,000, in 2,500 ord. and 2,500 pref. shares of £10 each. 500 pref. and 2,500 ord. shares taken up. £25,500 paid, being £10 per share on 2,500 ord., and £1 per share on 500 pref. Mortgages and charges: £15,937.

Singapore Electric Tramways, Ltd.—Sir William Plender, of 5, London Wall Buildings, E.C., was appointed receiver and manager by Order of Court dated August 3rd, 1922.

Electro-Metallurgical Extractions, Ltd.—Particulars of £10,000 debentures authorised July 13th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital, whole amount issued.

F. Patrick, Ltd.—Mortgage dated July 25th, 1922, to secure all moneys due, or to become due, from company to London Joint City and Midland Bank, charged on certain land at Swinnow in Bramley, Leeds.

CITY NOTES.

Marconi's Wireless Telegraph Co., Ltd.

The annual general meeting was held on Tuesday at the Connaught Rooms, Kingsway, Senatore G. Marconi in the chair. In proposing the adoption of the report the chairman said the past year had been one of unprecedented difficulty, not only for themselves, but for their many associated companies. He was glad to say that this year a manifest improvement had already shown itself in many directions, which gave considerable encouragement regarding the future. The net profit for the year, £275,361, was somewhat less than a year ago, but, feeling that the outlook was distinctly brighter, the directors felt justified in declaring the same dividend, which left £666,850 to carry forward to the credit of the profit and loss account. Whilst they could not pretend to feel satisfied with the results of last year, they nevertheless felt that they had come through a year of almost unprecedented depression with a result better than many of them had dared to hope. Since the last meeting the company had built new wireless stations at Ongar, Essex, which were serving for the conduct of their foreign telegraph business. They had also opened Radio House, in the City, which was now their head telegraph station, from which all their wireless telegrams were transmitted and received. Dealing with the company's claims against various Government departments for infringements of their patents, the chairman said that after they obtained judgment in their favour against the Admiralty in respect of the Lodge patent the matter was referred to the Royal Commission on Awards to Inventors to assess the amount of the compensation. Unfortunately, however, after the case had been heard some days the Admiralty put forward a claim to review the royalties which had already been paid in respect of apparatus supplied. As they could not assent to the Commission's dealing with their claim in that manner, and acting under the advice of counsel, they had taken steps to have the submission to the Royal Commission revoked, so that the settlement of the claim must be somewhat further delayed. As regarded the Post Office, they were still holding up the Petition of Right in anticipation of an amicable settlement. In recent weeks, at an interview between the Postmaster-General and some of the directors, a conversation of a very encouraging nature took place, which caused them to hope to be able to come promptly to an agreement of a comprehensive character. They had not yet been favoured with the promised communication, and could only assume that there must be some good reasons for the delay. It was sincerely to be hoped that the Post Office might now act promptly, for in consequence of indecision month after month and year after year in respect of matters of great importance this country had been sadly left behind in the erection of high-power stations. Referring to Imperial wireless stations and the decision of the Government to establish direct commercial communications with India, South Africa and Australia, Senatore Marconi recalled the action which had recently been taken by the Commonwealth Government of Australia in arranging for a comprehensive scheme of wireless development, the main feature of which, he said, was the establishment of a direct commercial service between Great Britain and Australia. The Australian Government had entered into an agreement with the Amalgamated Wireless (Australia), Ltd., a company which had an exclusive licence of all the patents of the Marconi and associated companies, and in which they held a substantial interest, by which they undertook to establish direct communication between Australia and Great Britain on the one hand, and Canada on the other, and it took over all the existing wireless services, to re-organise and develop them and establish the entire wireless industry of the Commonwealth on a progressive commercial basis. The Marconi Co. was entering into a contract with the Australian company to erect a station in Australia of 1,000-kW power, and they proposed, subject to the licence being granted, to erect a similar station in this country. Referring, in conclusion, to broadcasting, the chairman said that a broadcasting company was in the course of formation, which would erect some eight stations in different parts, whose radius would cover the whole country. They were taking part with all other manufacturers in the company, the sole object of which would be to broadcast the programmes consisting of concerts, educational matter, general information, and, in fact, anything and everything of general interest which from time to time the Post Office regulations permitted. Receiving sets were being placed on the market which would enable everybody at a small cost to receive those transmissions. Those instruments would be scientifically constructed and thoroughly reliable, and men, women and children utterly devoid of any wireless knowledge whatsoever would be able to handle them with ease. They were confident that such receiving apparatus would soon prove as popular in this country as it had proved in America, and it might well be that ere long here, as there, it would be regarded in every household as an article of necessity. They contemplated a very considerable revenue from the new industry, which should provide remunerative employment for some tens of thousands of men and women who had been so long suffering from the severe depression in trade. The one danger with which the industry was menaced, that arising from the depreciation of foreign currencies, had been boldly met and disposed of by the Postmaster-General. The nature of the business was such that the directors had decided upon the policy of granting manufacturing licences to several firms of repute upon terms not insignificant, but nevertheless reasonable, having regard to the value of their patents. Therefore, besides the "Marconiphone," which they might reasonably expect might be most generally in favour, there would be numerous other types of receiving apparatus produced under licence from the Marconi Co.

Mr. Godfrey C. Isaacs, in seconding the motion, remarked that, up to the present, the company had been almost entirely dependent for its business upon foreign governments. They had never had the million to deal with, but with broadcasting they had a public with whom they expected to do a

very big business. There was also now opening up a very excellent prospect of very considerable business in all parts of the world with private customers in wireless telephones. Those new enterprises should benefit, not only the Marconi Co., but the various associated companies in which they held shares.

The report was adopted.

German Companies.

The *Electro-Trust Co.*, of Berlin, which is a financial undertaking associated with the A.E.G. and the Siemens group, reports net profits of 683,000 marks for 1921-22, as compared with 651,000 marks in the previous year. The rate of distribution is 6¼ per cent., as in 1920-21.

The report of Brown, Boveri & Co., of Mannheim, states that the demand was exceptionally brisk in 1921-22. After writing off 2,500,000 marks for depreciation the accounts show net profits of 16,204,000 marks, and the dividend rises from 10 per cent. in 1920-21 to 15 per cent. last year. It has been decided to increase the ordinary share capital by 25,000,000 marks to 175,000,000 marks. The report expresses the hope of participation in the forthcoming orders for locomotives for the Bavarian State Railways.

The *Isaria Meter Works Co.*, of Munich, which belongs to the Brown-Boveri group, reports net profits of 13,828,000 marks for 1921-21, as against 7,897,000 marks in the preceding year. The former figures have been arrived at after deducting 1,864,000 marks for depreciation and placing 1,169,000 marks to a works' maintenance fund. It is proposed to pay a dividend and bonus at the rate of 40 per cent., as against 15 per cent. in 1920-21.

Italian Companies.

Elettricità Alta Italia (capital 48,000,000 lire).—In the past year the company has fully exploited its distribution network. The accounts closed with a net balance of 4,550,000 lire, which allowed of the distribution of a dividend of 8 per cent.

Società Idroelettrica Piemonte (capital 40,000,000 lire).—The report of the council showed that the company had steadily fulfilled its programme in the supply of half a milliard of kWh. The company had taken over the direct working of the Montjovet station. The accounts realised an available balance of 3,725,044 lire, with a distribution of 8 per cent. on the shares.

Società Anonima Officine di Energia Elettrica di Novara (capital 7,500,000 lire).—The balance on December 31st, 1921, was 102,000 lire, which allowed of a dividend of 10.50 lire on each 150-lire share.

Società Varesina per Imprese Elettriche (capital 12,325,000 lire).—The company had been able to secure a considerable supply of current from Switzerland; the obligation to furnish current to the Porto Ceresio railway will shortly terminate. The balance allowed of the distribution of 5 lire per 85-lire share.

Società Elettrica Milam (capital 10,000,000 lire).—The balance of 331,000 lire allowed of the distribution of 4 per cent., dating from July 1st, 1922.

Società Anonima per Distribuzione di Energia Elettrica Ing. Banfi (capital 1,800,000 lire).—The accounts closed with an available balance of 536,754 lire, allowing of a dividend of 25 lire on each 100-lire share.

Società Pavese di Elettricità A. Volta (capital 700,000 lire).—The balance available for dividend, amounting to 195,773 lire, permitted of 7.65 lire on shares to bearer and 9.15 lire on named shares.

Società Anonima di Elettricità del Ticino (capital 700,000 lire).—The year closed with a balance of 194,229 lire, from which a distribution of 15.30 and 18.24 lire to shares to bearer and named shares respectively was authorised.

Società Elettrica Saronnese (capital 500,000 lire).—The working year 1921 realised a profit of 117,913 lire, allowing of a dividend of 10 lire per share.

Società Elettrica Interprovinciale (capital 10,500,000 lire).—The accounts showed a net balance of 685,000 lire, which permitted the distribution of 6 per cent. dividend.

Società Friulana di Elettricità (capital 3,500,000 lire).—The net balance with which the working closed permitted the distribution of a dividend of 23.75 lire per share.

Idroelettrica Ligure Meridionale (capital 550,000 lire).—The accounts showed an available balance of 96,676 lire, from which a distribution of 20 lire per share was made.

Società Ligure de Elettricità (capital 250,000 lire).—The excessive drought had exceptional consequences for the working during 1921, having caused the exhaustion of the company's storage reservoirs. Notwithstanding this, a profit of 41,116 lire was earned, from which a dividend of 7 lire per share was distributed.

The following increases of capital have been made:—Unione Tarantina Elettrogas C. Cacise e C. di Taranto, from 1,600,000 to 2,000,000 lire; Società Forze Idroelettriche Abruzzesi, from 1,500,000 to 3,000,000 lire; Società Elettrica Alto Cremonese, from 800,000 to 1,600,000 lire; Società Anonima De Rossi e C. Imprese Elettriche Idrauliche di Nocera Inferiore, from 225,000 to 1,000,000 lire; and Impresa Elettrica Paravicini, from 47,000 to 600,000 lire.

The *Società Anonima Elettricità Toscana* is distributing 30 lire per share dividend, as the result of the working year 1921; it has enlarged its network and taken over the lighting of the whole of the city of Pisa, where it is located.

The *Società Boracifera de Lardarello* has realised on the working of 1921 a net balance of 855,781 lire, out of which 10 lire per share is to be distributed.

Dividends of 7 per cent. are distributed by both the *Società Marchigiana per Imprese Elettriche*, of Trieste, and the *Società Imprese Elettriche*, of Macerata; as also by the *Società Iesini di Elettricità*, of Iesi.

Closing with the substantial balance of 1,128,397 lire for the year 1921, the *Società Elettrica dell' Italia Centrale* (Rome), whose capital is 12,000,000 lire, has distributed a dividend of 8 lire per share. On the other hand, the *Società Generale per la Illuminazione* (Naples) has sanctioned a dividend of 11.25 lire on a capital of 16,200,000 lire, on the strength of a net balance of only 869,944 lire.

Dividends of 7 per cent. have been fixed in the cases of the three following companies:—*Elettrica del Mezzogiorno d' Italia*, *Elettrica Brindisina*, and *Messines per Imprese Elettriche*, the ordinary shares of the last-named receiving 8 per cent.; the same amount was also sanctioned in the case of the *Elettrica Peloritana, of Messina*.

French Companies.

The *Compagnie Continentale Edison*, of Paris, reports that the results achieved in 1921 were much more favourable than those of the preceding year, and the undertakings in which the company is interested began to emerge from the period of depression. The net profits amount to 439,000 fr., and the dividend is at the gross rate of 25 fr. per share.

The *Société des Ateliers de Constructions Electriques de Lyon et du Dauphiné* states that the scarcity of orders in 1921 brought about ruinous competition and a great fall in sale prices. Referring to the expansion in hydro-electric works and steam generating stations, which is to take place between the present time and 1926, the report states that the company is well equipped for participating in this development. The net profits and balance forward amounting to 415,000 fr., has been carried forward.

The report of *L'Appareillage Electro-Industriel* (*Pétrier, Tissot et Raybaud*) of Lyons, states that although the results obtained in 1921 were inferior to those of the preceding year, they were still satisfactory having regard to the industrial and commercial crisis. In order to remedy the reduction in the volume of the turnover the directors had endeavoured to extend the scope of activity by establishing new depôts and agencies, and by increasing the number of representatives and workers, both in France and abroad, so as to provide new markets, both for high and low-pressure apparatus. After having applied 150,000 fr. to depreciation the net profits are returned at 313,000 fr., and the dividend is at the rate of 60 fr. gross per share.

The *Compagnie des Produits Chimiques et Electrometallurgique Alais, Forges et Camargues*, reporting on the past year, states that the economic crisis had compelled the company entirely to close some of the works, which are still lying idle to-day. The market for aluminium, which remains the principal product made by the company, experienced a slight recovery during the concluding month of 1921 as a consequence of the gradual disappearance of the stocks which were formed in war-time. In June the sales in France were being maintained at a higher level than in 1913, which was the last normal year. The net profits in 1921 were 66,000 fr. If the results did not permit of the payment of any dividend the report states that the company nevertheless paid over 5,500,000 fr. in taxes to the State.

The *Société de Forges et Ateliers de Constructions Electriques de Jeumont*, after referring to the financial interests held in the *Ateliers de Constructions Electriques de Charleroi* and in other undertakings, states that the company's own works were well occupied in 1921, and the value of the turnover exceeded 100,000,000 fr. During the first months of 1922 the orders booked, despite the fall in sale prices, were greater than at the corresponding period in 1921. The electric railway construction sydicate, which had been formed in connection with the Schneider Co., of Creusot, had received orders for 80 goods locomotives and 80 automobiles for the Paris-Orleans Railway Co., one locomotive for the Paris-Lyons-Mediterranean Railway, and 30 locomotives for the State Railway; and the company was now favourably situated for the execution of these orders. The cable factory was well provided with orders for cables of all kinds, and among others underground cables for 60,000 volts had been manufactured for the *Union d'Electricité*, of Paris. After having made provision for depreciation, the accounts show net profits of 11,057,000 fr. for 1921, permitting of the payment of a dividend at the gross rate of 25 fr. (10 per cent.) per share on capital of 80,000,000 fr.

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted:—

Siemens Bros. & Co.—£466,000 4½ per cent. debenture stock.

Whitehall Electric Investments.—1,500,000 7½ per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 1,500,000; and £2,500,000 6 per cent. first mortgage debenture stock, 1925-42.

Yorkshire Electric Power.—36,940 ordinary shares of £1 each, fully paid, Nos. 6,991 to 15,930, 270,381 to 270,990, 278,231 to 279,030, 378,101 to 378,600, 429,251 to 429,350, 494,571 to 495,320, 530,991 to 533,000, 611,711 to 612,210, 639,281 to 640,480, 674,161 to 674,830, and 791,231 to 791,490.

Prospectus.—*Ashley Wireless Telephone Co., Ltd.*—There has been in circulation a prospectus offering for subscription an issue of 50,000 shares of £1 each at par in this company, which has been formed "to exploit the commercial side of wireless telephony," and has acquired the business, &c., of the Ashley Radio Co., wireless telephone engineers and manufacturers, of 69, Renshaw Street, Liverpool, the present proprietors of which (Messrs. W. A. Brooke and W. A. McKillop) have joined the board. The issue is made to provide the necessary capital "to cope with and develop the very large and increasing business." The existing works being insufficient, new ones are to be built, and by mass production the concern will place broadcasting apparatus before the public. It is stated that the Ashley Radio Co. has on hand orders for over £65,000 worth of wireless material, and that it possesses "valuable concessions governing manufacture which will be carried out under licence"; further, that it "will become" a member of the Broadcasting Co. now being formed by other wireless manufacturers in this country." The company claims to be "in a unique position in being one of the earliest in the field." £7,000 is to be paid for the business and assets of Ashley Radio Co. and £1,000 for goodwill. It is admitted in the prospectus that as the industry is a new one it is not possible to estimate accurately what the profits of the company will amount to, but substantial dividends are predicted. The list was to close on Tuesday last. The investment is, of course, one of a highly speculative character.

Sheerness and District Electric Power and Traction Co., Ltd.—The net revenue for the past year was £8,289, after meeting debenture interest, &c. The debit balance brought forward is turned into a credit balance of £1,736, which is to be carried forward.

Clyde Valley Electrical Power Co.—Interim dividend for the half-year ended June 30th of 2½ per cent. actual, less tax.

Penarth Electric Lighting Co., Ltd.—Dividend 7½ per cent.; £1,503 to reserve; £2,533 carried forward.

Banbury and District Electric Supply Co., Ltd.—Dividend 3 per cent., carrying forward £1,116.

Birkdale and District Electric Supply Co., Ltd.—Dividend 8 per cent.; £3,500 to reserve; £3,329 carried forward.

Waste Heat and Gas Electric Generating Stations, Ltd.—Interim dividend, 1½ per cent. for the half-year ended July, 1922.

Liverpool & District Lighting Co., Ltd.—Interim dividend of 2½ per cent. actual, less tax.

STOCKS AND SHARES.

TUESDAY EVENING.

THERE has been a little stiffening of rates in the Money Market. Not enough to cause any talk about the bank rate, but sufficient to add an element to the restraining influences of holiday-time and the unsettled political outlook abroad. The mad movements in the mark have ceased to operate as a factor of real disturbance. Stock Exchange markets are tolerably steady, and the activity in South African shares serves to redeem the House from the charge of being wholly uninteresting.

The Home Railway department shows a mild degree of animation, too, and the Electric Railway stocks are mostly harder. Metropolitan Consolidated has risen a little over 50 xd, and Districts touched 40 before reacting a trifle. Underground Electric Railways issues are all harder. The new stock in the railway department, whose advent was indicated in this column three weeks ago, is taking the shape of a Central London debenture stock. City & South London 4½ per cent. debenture and the similar security of the London Electric Railway are both quoted at 2 premium.

County of London new ordinary, issued at 22s. 6d., are higher at 3s. 3d. premium, and the 6 per cent. preference, which came out at 20s., are up to 1s. 9d. premium. The latter price, even more than the former, shows how tightly investors will hold to a first-class industrial stock: in spite of what is obviously a tempting profit, the shares are not offered with any degree of freedom, and 2s. premium has been paid for them. British Thomson-Houston new 7 per cent. preference stand at 20s. 3d. Bengal Telephone scrip holds its premium of 3 points, and there is not much change in the trio of Indian Electric stocks recently issued. The Calcutta Tramways sevens are 2 premium, Indian Electric tax-free fives keep around the issue-price of 94, and Madras sevens, which came out at 95, are 5s. premium.

Practically the only alterations in the electricity supply group other than those in the new County of London, are due to the marking ex-dividend of various ordinary shares. Charing Cross ordinary, for instance, are 7½; so are Westminsters. County ordinary remain at 1½, St. James' at 8½, while Metropolitans at 5½ xd. have recovered the dividend deducted last pay-day.

Edison Swans are a few pence easier at 3s. General Electric ordinary at 18s. 3d. are sixpence down. Of the engineering shares, Babcock & Wilcox gave way to 58s. 9d. Iron and coal shares are mostly heavy, by reason of a dividend disappointment from the Powell-Duffryn Co. Victoria Falls & Power ordinary shares at 14s., and the preference at 23s. 6d. have not derived much advantage this week from the Cape-inspired activity amongst Kaffirs.

The Marconi meeting was held to-day, Tuesday, but the price underwent no immediate change as a consequence. The report came as a pleasant surprise, the figures being distinctly better than many people had expected would be the case. The price rose ¼ to 2¾, but this brought in sellers again, and it reverted to 2½. Canadian Marconis have drooped to half-a-guinea, and Radios hold their previous prices of 19s. 6d. for the common, 14s. for the preferred.

Eastern Telegraph ordinary is 1¼ lower at 185, and Eastern Extensions at 18¾ are 2s. 6d. down. Globe ordinary, on the other hand, rose to 19½, and Westerns, after being better, are now 19, holding their improvement of the previous week. Anglo-American Telegraphs continue dull, the preferred and deferred both showing small declines.

Mexican matters make no further headway, and prices in the Utility group move rather aimlessly. Mexican Light and Power common shares, as an example, are a point higher, although the first mortgage bonds at 65½ are similarly easier. Anglo-Argentine Tramways second preference are firmer, and Brazilian Tractions ¼ lower. The modest nature of the changes indicates the lack of interest taken in this section at the present time. Rubber shares are lifeless, and there is practically nothing doing in their market.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1920.	Dividend 1921.	Price Aug. 15. 1922.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	12	12	7¼	—	£8 0 0
Charing Cross Ordinary...	8	9	7½xd	—	5 17 0
do. do. do. 4½ Pref. ...	4½	4½	4	—	5 12 6
Chelsea	6	6	6	—	5 0 0
City of London	14	14	2½	—	6 18 0
do. do. 6 per cent. Pref....	6	6	22/6	—	5 6 8
County of London	8	8	1½	—	5 16 5
do. do. 6 per cent. Pref....	6	6	1½	—	5 7 6
Kensington Ordinary	9	10	7½	—	7 0 7
London Electric	2½	4	2½	—	5 11 6
do. do. 6 per cent. Pref....	6	6	5	—	6 0 0
Metropolitan	7	7	5½xd	+ ½	6 7 6
do. 4½ per cent. Pref....	4½	4½	4	—	5 12 6
St. James' and Pall Mall	12	12	8½	—	6 17 2
South London	7	7	8½	—	8 0 0
South Metropolitan Pref.	7	7	1½	—	5 18 0
Westminster Ordinary	10	10	7½xd	—	6 10 0
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref	6	6	103	—1	5 16 8
do. Def.	1½	34/6	28½	— ½	7 9 0
Chile Telephone	6	6	6	— ½	5 0 0
Cuba Sub. Ord.	7	7	8½	—	8 4 8
Eastern Extension	10	10	18½	— ½	5 9 1
Eastern Tel. Ord.	10	10	185	—1½	5 8 1
Globe Tel. and T. Ord.	10	10	19½	+ ½	5 8 5
do. do. Pref.	6	6	11½	—	5 6 8
Great Northern Tel.	24	22	29	—	7 11 8
Indo-European	10	10	86½	—	6 17 0
Marconi	25	15	2½	—	6 13 4
Oriental Telephone Ord.	12	12	23	—	*5 1 1
United R. Plate Tel.	8	8	7	—	*5 14 4
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	19	—	*5 5 8
HOME RAILS.					
Central London Ord. Assented ...	4	4	68	—	5 17 8
Metropolitan	1½	2½	50½	+2	4 9 0
do District	Nil	1	89½	+1½	2 11 6
Underground Electric Ordinary ...	Nil	Nil	2½	+ ½	Nil
do. do. "A"	Nil	Nil	7/-	+6d.	Nil
do. do. Income ...	2	4	83½	+1	*4 16 7
FOREIGN TRAMS, &C.					
Anglo-Arg. Trams, First Pref. ...	5½	19½	3½	—	7 17 2
do. do. 2nd Pref.... ...	Nil	5½	21½	+ 7/6	7 0 9
do. do. 5 per cent. Deb. ...	5	5	82	—	6 2 0
Brazil Tractions...	Nil	Nil	49½	— ¼	8 1 0
British Columbia Elec. Rly. Pfd.	5	5	76½	+ ½	6 9 9
do. do. Preferred ...	6	98/-	68½	—	*6 15 0
do. do. Deferred ...	3	124/-	74½	—	*8 5 10
do. do. Deb.	4½	4½	76	—	5 11 0
Mexico Trams. 5 per cent. Bonds ...	Nil	Nil	72½	—	—
do. do. 6 per cent. Bonds ...	Nil	Nil	45½	—	Nil
Mexican Light Common	Nil	Nil	22½	+1	Nil
do. Pref.	Nil	Nil	61	—	Nil
do. 1st Bonds	Nil	5	65½	—1	7 11 9
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	2½	— 1/6	5 7 4
British Aluminium Ord.	10	10	18/3	—	—
British Insulated Ord.	15	15	2½	—	7 1 2
Callenders	15	15	2½	—	7 1 2
„ 6½ Pref.	6½	6½	1½	—	5 9 5
Crompton Ord.	10	5	15/-	—	6 13 4
Edison-Swan	10	Nil	3/-	—3d.	Nil
do. do. 5 per cent. Deb. ...	5	5	64	—	7 16 4
Electric Construction	10	10	1½	—	8 0 0
English Electric	8	5	17/6	—	5 14 8
do. do. Pref.	6	6	18/9	—	6 8 0
Gen. Elec. Pref.	6½	6½	22/-	—	5 18 2
do. Ord.	10	5	18/3	—6d.	5 8 0
Henley	15	15	2½	—	6 13 4
do. 4½ Pref.	4½	4½	4½	—	5 2 10
India-Rubber	10	—	½	—	—
Met.-Vickers Pref.	8	8	9½	—	6 11 2
Siemens Ord.	10	10	27/-	—	*7 8 2
Telegraph Con.	20	20	26	—	*4 12 2

* Dividends paid free of Income Tax.

FALSE MARKING AND DESCRIPTION OF GOODS WITH SPECIAL REFERENCE TO ORIGIN.

By THEODORE RICH.

Part III.—Some Pre-War Practices.

Before we can deal with the law on the subject of false trade descriptions it is desirable to point out some of the things which took place before the war, and which will undoubtedly to a greater or lesser extent take place in the future. The question is not merely that of marking but of arranging such surroundings so that the average purchaser of reasonable intelligence will assume that the goods are what, to the knowledge of the manufacturer, merchant, wholesaler or retailer, they are not.

There are a number of ways in which a *de facto* false trade description can be given to goods, but the question is whether it is false within the meaning of the Merchandise Marks Act or under the common law. As an example, a trader of alien origin paints his shop front green, calls himself some such name as the Sligo Linen Company, surrounds his window with shamrocks, and displays in his window and sells cotton handkerchiefs from Manchester or Germany. In such cases the intent to deceive is obvious, but under our law "it is no part of the duty of the Court to enforce the observance of the dictates of morality," and the question is whether an action can be taken in such cases.

Deceptive Business Names.

According to evidence given before the 1920 Committee inquiry (Ref. No. 1,142) "There is a firm trading under the name of an Irish county. They have a number of shops in this country as well as in Ireland, and you might visit their shops every day in the year, and I doubt if you would find Irish goods in any one of them." "We consider it is a very weak point of the law to permit such a thing."

Under the law there is nothing to prevent men who are, apart from easily obtainable naturalisation papers, "alien to the core," from trading as a limited company or a private firm, provided it is registered under any name, however patriotic. This is done every day. A case came into Court some years ago where an English typewriter girl had been asked to pick out a combination of suitable Anglo-Saxon names, and this was, according to law, registered as a title for a limited company, nobody of any of the names having anything to do with the business.

One is entitled to assume that the normal transactions of firms who adopt such artifices will be tinged with fraud and trickery, the use of such names being obviously intended to deceive the public regarding the maker or origin of the goods sold. This sort of thing is called smart business among those to whom old-fashioned honesty is looked upon as synonymous with stupidity.

Deceptive Brands.

Not only can a trader adopt for himself any name he likes in order to deceive the public, but he can brand the goods he sells how he pleases to give the public a false impression, provided he does not imitate the name of another firm so closely as to get within the reach of the law.

In 1904, in a certain case, the defendants, wine merchants, had adopted a Scottish trade name for some whisky they were selling. There was no concern of that name manufacturing for them, and the successors of a firm of the adopted name objected. Doubtless to many whisky drinkers the new name would be more attractive than the original.

Lord Justice Vaughan Williams said: "I have not the slightest sympathy with the defendants or with their mode of conducting business, and I am very sorry myself that, according to the law of this country, you can for trade purposes adopt a name which is not yours." He said the defendants had adopted a picturesque name because they hoped that customers would draw favourable inferences with respect to the wares they sold.

Complaints have been made from time to time that concerns whose policy has been controlled by foreign directors or their nominees have put up works in this country and then sold material quantities of foreign goods not marked with place of origin, sometimes marked with trade marks registered by the superficially British house aided by the use of catalogues, advertisements, and letter paper marked "Works So-and-So."

For instance, before the war when the policy of a certain electrical manufacturing company was practically controlled by men of German origin, a number of illustrated catalogues were sent out not merely to the home market, but also to Colonial markets marked "Works So-and-So" (an English town); the catalogues did not include the names of the German towns, where a material proportion of the work was done.

"Our Works."

Before the war another concern sent out circulars marked in prominent letters some such words as British Association cable, works so-and-so; empty drums to be returned to "our works." Samples were sent out with labels marked in a similar manner. The average buyer was not in a position to know that the cable was of German make.

Another concern, which was taken over by the Public Trustee during the war and was largely controlled by a German firm, sold certain machines before they started making them in England; when the machines were delivered they had on them a small label, "Made at our branch factory in Hanover." People do not always see what they are going to buy; the name of the company was obviously chosen to deceive, and even the label was deceptive: it was claiming that the tail was wagging the dog, the parent house being in Germany.

Before the war very large quantities of German electrical fittings and accessories of English pattern were sold in this country with no mark of origin, quantities being sold through small retailers. Examination of German war store depôts in the North of France showed that quantities of German-made electrical accessories of English and French pattern, which could not be forwarded to their original destinations, were sent forward for use by the German troops, many of them being fitted with zinc or galvanised iron metal work. At one time it was not unusual for some contractors to buy German switches and fit them on to British switchboards for sale at home and abroad. Before the advent of the metallic filament lamp, large quantities of carbon lamps made in Holland were sold under the name of the "London lamp."

In the 1890 inquiry complaints were made of the business in imported goods which were passed through the Customs safely and then a deceptive mark was put on, in some cases after the old mark had been removed.

In the 1919-20 Committee Inquiry, evidence was given about gas mantles (D. 1841). "A British firm, German owned; they called themselves a British firm" used to import 10 million gas mantles a year in a partly finished state. The mantle was "stamped with an English name, finished and boxed in England, and sold as an English mantle." (D. 1843.) At one time when German mantles had a better reputation than those from other countries "a Dutchman, who made mantles before the war, stamped his mantles 'Made in Germany' in order to deceive the British buyer."

In these days a notice on an advertisement, circular, or on a package to the effect that it is an "all-British house" means only too often a "British subjects' house," a concern run by men who are by appearance,

speech, and deceptive inborn instincts as "alien" as they possibly can be, and even "made by British labour" may mean that the goods are made by men who know more German than English.

It is a great pity that although such large quantities of German electrical goods were sold before the war without definite indication of their origin, no representatives of the electrical trade as such took part in the 1919-20 Marks Committee; nowadays, it is often difficult to sort out the "wheels within wheels."

During and Since the War.

As early as Christmas, 1919, scores of shops selling fancy articles sold unmarked German goods, and it is well known that a material proportion of the merchants and wholesalers in the fancy goods trade are men of alien extraction; it is, therefore, not astonishing that such men have for years opposed the honest marking of imported goods.

During the war many of those who were foiled in their efforts to obtain imitation British goods from their brothers and cousins in Berlin and Vienna made arrangements to obtain them from the Japanese, the Germans of the East, and therefore, as evidenced by the 1919-20 inquiry, imitation British goods of many classes, from bolts and bicycle parts, to bootlaces, were brought over, many of the things being marked with deliberately deceptive names. India and the Far East have been flooded with falsely marked Japanese goods, especially cheap hardware, a great deal of it of the poorest quality, and although few European customers were deceived, there is little doubt that the reputation of British goods was severely injured by such practices. It is well known that during and since the war a number of Germans began to get a foothold in manufacturing businesses in Holland, Switzerland, and elsewhere, so as to be able to forward assembled or disguised German goods to the countries of the Allies.

According to D. 1835, in the first year after the outbreak of war, 40 million mantles came into this country from Holland. "Holland could not produce all these goods." They were marked "Made in Holland."

Recent legislation, in the teeth of public opinion, so far from opposing false indications of origin, has made deliberate steps to assist them. In the German Reparation Act, Section 2, goods are not counted as German provided "twenty-five per cent. or more of the value of the goods is attributable to processes of manufacture undergone since the goods last left Germany," and in the case of the Safeguarding of Industries Act, 1921, duty is not paid if "twenty-five per cent. or more of the value of the goods at the time of export to the United Kingdom is attributable to processes of manufacture undergone since the goods last left any country in relation to which such an order has been made."

It is obvious that this clause has been put in to reduce the Act to little more than a farce, as assembly, a coat of paint, a label, and packing could in many cases be made to satisfy Customs officials, who are not likely to make extra work for themselves.

During the war, when the Government was forced to yield to public pressure, "anything owing more than 25 per cent. of its cost to German material was treated as a German article, A 1,863, but since the war the situation has been reversed."

Classification.

When dealing with false marks or lack of marks of origin, the following classification will be found convenient:—

I. Goods made abroad and sent into this country to be sold as if they were British.

II. Goods made abroad, mainly or wholly in one country, and sent out or marked as if made in another (*a*) sent here, (*b*) sent direct to another foreign country.

III. Goods made abroad to the order of British merchants, sent to this country falsely marked or with deceptive marking for reshipment to countries where the retailer or ultimate buyer will assume that they are British. (Transit trade.)

IV. Goods made abroad and sold in the country of origin falsely marked as if of British make.

V. Goods made at home in one district and marked or sold as if made in another (*e.g.*, Manchester goods sold as Irish).

Of the above, I, II*a*, III and V are affected by British Law, II*b* and IV can be dealt with in theory by foreign law and by diplomatic representations.

The Treaty of Peace at Versailles contains Article 274, in which . . . "Germany undertakes to prohibit and repress by seizure and by other appropriate remedies the importation, exportation, manufacture, distribution, sale or offering for sale in its territory of all goods bearing upon themselves or their usual get-up or wrappings any marks, names, devices, descriptions whatsoever which are calculated to convey directly or indirectly a false indication of the origin, type, nature or special characteristics of such goods."

Owing to the number of friends of Germany in high places in nearly every country in the world, this clause is likely to be as valuable as most of the other clauses in the Treaty.

The great difficulty regarding questions of origin has always been the textile trade and the very strong pro-German element which has unfortunately worked its way into it. Wool, fibres, cops, yarns, materials unbleached, bleached, dyed, callendered, and so on, go backwards and forwards to the Continent in a most bewildering manner, and it is therefore much more difficult to deal with textiles than with other goods. Unfortunately, legislation has taken goods as a whole; what is one trade's food may be another trade's poison. Many people have taken advantage of the peculiar conditions and prejudices of the Manchester trade to checkmate steps desirable for the promotion of honest trade in other directions. There is no reason why textiles should not receive special treatment where future legislation is concerned.

Proprietary Rights and National Interests.

Whenever goods are sold under false marking or trade descriptions, the cases can be divided into two groups:—

(*a*) Where proprietary rights of individuals or corporate bodies are infringed, for instance, where trade marks, trade names, a firm's name, get-up, packing, or where by means of deceptive ticketing or display, goods are sold in such a way that the purchaser, when purchasing goods of one maker, thinks he is getting those of another (with perhaps a better reputation earned by intrinsic merit or skilful advertising).

(*b*) Where the interests of a territorial group of individuals are affected as where, for example, German or Japanese goods are marked, got up, or displayed as British, Sheffield made, Irish, or French, that is to say, sold as if they were made in a certain place or country or by members of a certain group when they were not.

It can be well understood that when goods of some specific firm have been imitated, either by false trade marks, get-up, or display, the party who is most likely to initiate proceedings, whether civil or criminal, is usually the party directly injured. It is in his interests to act as far as the trade in question justifies. Where, however, a certain territorial group has earned a reputation for quality, or where the conditions under which manufacture is carried out, or political circumstances, tend to create a moral duty to give some sort of preference to, or legitimate prejudice for, goods from some national territorial or craft group; then if goods made elsewhere, whether in fact of better, equal or worse quality, are exposed for sale in a deceptive manner, the whole group is injured; people intend to confer their custom in one direction, as they have every right to do, while in fact it is going in another. It is obtaining trade by false pretences.

Esprit de corps is naturally weaker in trade where men are in daily competition than in the army or in professions, and it is much more difficult therefore to get men to make a move in directions meaning considerable expense and inconvenience, in order to safeguard the interests of trade as a whole. If German or

Japanese lampholders are sold as British, it is difficult to say to any one maker, "It is your duty to take steps to stop this." What is everybody's business is too often nobody's business.

It is in the interest of everybody that honest trade should be encouraged, but individuals, societies, and associations hesitate to set the law in motion.

Accusations of Trade Jealousy.

For thirty years many manufacturers have been urging that the Government should take up prosecutions, especially in cases of false marking of origin, the difficulty being that over and over again, as evidenced even in the 1890 report, those who take up such questions in the interest of the trade as a whole are almost invariably accused by the defence of being actuated by "vindictiveness, or spite, or rivalry in trade," the Court, especially a local bench, is then biased. In some cases matters have been made so uncomfortable for those who spent their time and money that they have refused to move again, to the natural delight of the dishonest trader and merchant. The same objection, to a lesser extent, attaches to cases that trade associations take up.

ELECTRICITY DISTRICTS.

Commissioners' Decisions.

The conclusions arrived at by the Electricity Commissioners as the result of two local inquiries held by them recently came to hand too late for publication last week; they are summarised hereunder.

North-West Midlands Electricity District.

The evidence given at the inquiry* held at Wolverhampton in February last with respect to the scheme submitted by the Conference of Authorised Undertakers (the promoters), and the counter-proposal submitted by the Corporation of Walsall for a part only of the district, has been considered, and the Commissioners have arrived at the following conclusions:—

The Electricity District as provisionally determined† should be confirmed subject to the following adjustments:—

The *inclusion* of the municipal borough of Stourbridge, the urban districts of Rowley Regis, and Lye and Wollescote, and the remaining detached portions of the rural district of Tutbury situated within the rural district of Uttoxeter.

The *exclusion* of the municipal boroughs of Macclesfield and Tamworth, the urban districts of Alsager, Bollington, New Mills, Perry Barr, Sandbach, and Yeardsley-cum-Whaley; the rural districts of Congleton, Disley, Dudley, Hayfield and Macclesfield; that portion of the rural district of Tamworth originally included in the district; the parish of Kinver in the rural district of Seisdon and portions of the parishes of Great Barr in the rural district of Walsall and Shenstone in the rural district of Lichfield.

The *exclusion* of the detached part of the rural district of Church Stretton known as the parish of Sibdon Carwood, and of the detached part of the rural district of Uttoxeter situated in the rural district of Tutbury.

The *retention* of the municipal borough of Congleton notwithstanding the statement of conclusions issued by the Commissioners on April 22nd, 1921, in respect of the North Wales and Chester Electricity District.

The technical scheme submitted by the promoters‡ (subject to modifications) will materially improve the supply of electricity, especially within the southern portion of the district which includes the important Cannock collieries area. The Commissioners approve the proposal immediately to extend the system of interconnection now existing between the generating stations at Wolverhampton, Ocker Hill, and West Bromwich by the inclusion of Walsall, and to complete the system of transmission to the Cannock area. Subject to satisfactory proof of a sufficient summer flow in the River Trent at Rugeley, the Commissioners generally approve of the proposal to construct the first section of a capital station at Rugeley, which will be required as soon as the limited local extensions of generating plant at Wolverhampton, Ocker Hill, and West Bromwich proposed by the promoters, and a possible limited extension at Walsall, have been effected. An improvement can be made in the promoters' system of transmission for the southern part of the district which, while maintaining the required capacity and efficiency, will result in a saving of capital expenditure and in the serving of a wider area. When drafting the outlines of the technical scheme for inclusion in the Order, the Commissioners will confer with the promoters on this point.

The proposal of the Walsall Corporation to extend the Birchills station by a further 30,000 kW of generating plant would not be practicable having regard to the limitations on the supply of condensing water, and in comparison with the Rugeley development would not conduce to economy of supply, either in the borough of Walsall or in the district. Subject, however, to the necessary consent of the Birmingham Navigation Co. being obtained to the use of the requisite amount of canal water for condensing purposes (1,200,000 gallons per hour) under the existing agreement between the Corporation and the company, the Commissioners are of opinion that there is sufficient water available without recourse to cooling towers to enable a load of about 15,000 kW to be supplied from Birchills, involving, at the most, an addition of two 5,000-kW sets to the plant at that station.

Including the local extensions proposed by the promoters, and the possible extension of the Birchills station, the total plant which can be installed at the four generating centres in the southern area of the district is as follows:—

1. Ocker Hill (Midland Electric Corporation for Power Distribution, Ltd.)	24,000 kW
2. Walsall	23,000 kW
3. West Bromwich	7,000 kW
4. Wolverhampton	26,000 kW
Total	80,000 kW

This aggregate of plant, after interconnection of the stations and making due allowance for spare generating plant, should be sufficient to meet the estimated needs of that area, including colliery supplies, until the first section of a new generating station at Rugeley is completed. Meanwhile, and pending the full development of the approved technical scheme for the district, the Commissioners will determine at which of the generating stations, when interconnected, extensions are to be made to meet the growth of load as occasion arises. New demands in the Stafford and Stoke-upon-Trent area, and especially in the more northerly part, can be more economically met for a time from a limited extension of those stations rather than by an extension of the main transmission system from the proposed station at Rugeley, and this alternative will require careful consideration by the Joint Electricity Authority when established.

The proposal of the promoters to constitute a Joint Electricity Authority is approved, but the Commissioners have come to the conclusion that to limit the Joint Authority to representatives only of authorised undertakers who are actually operating would not be in the best interests of the undertakers or of the development of supply in the district. A reasonable representation should be afforded to those local government bodies in whose areas there are at present no supplies of electricity, to the important coal industry, and to the railways, which indicated that they were prepared to contribute a reasonable share of the administrative expenses of the Joint Authority. The total representation of these other interests should not exceed one-third of the total membership of the Joint Authority.

The Commissioners are unable to accept the proposal of the Walsall Corporation that there should be a separate district with a separate authority for the southern portion of the area. However, it will be advantageous to the district for the work of the Joint Authority to be subdivided between committees for the northern and southern portions respectively. The voting proposals of the promoters would not be conducive to efficient administration; each member of the Joint Authority should have one vote only.

Part of the promoters' scheme is to make arrangements as soon as possible after the establishment of the Joint Authority to transfer to it certain generating stations upon terms which are now under consideration. Only those stations which are forthwith to be interconnected need be transferred to the Joint Authority as soon as it is established; the transfer of other stations should be delayed until their interconnection at a subsequent period with the main transmission system. The Commissioners will assist the promoters, if desired, in settling the terms of such transfer.

Regarding the position of the Shropshire, Worcestershire and Staffordshire Electric Power Co. (the Power Co.), by the terms of its Act of 1918, the Power Co. may not supply within this electricity district (except, by consent, within the areas of Walsall, West Bromwich, and the Midland Electric Corporation for Power Distribution, Ltd.) until August, 1923, and during this period nothing is to prejudice any application to procure the cessation or revocation of the Power Co.'s powers in an area comprising the counties of Salop and Stafford (excluding Smethwick) and that part of the county of Worcester then within the area of the Midland Electric Corporation. The promoters and the Power Co. should adjust the area of the Power Co. so that any proposals to amend that area may form part of the approved scheme for the district.

The Commissioners have accordingly decided to prepare a draft Order (*a*) providing for the establishment

*Elec. Rev., p. 317; March 3rd, 1922.
†Elec. Rev., p. 307; September 17th, 1920.
‡Elec. Rev., p. 231; August 12th, 1921.

of a Joint Electricity Authority for the district, with the borrowing and other financial powers conferred by the Electricity (Supply) Act, 1922. Provision will also be made for the sub-division of work between two committees, one to operate in the northern area, and the other in the southern area; (*b*) embodying the outlines of the technical scheme to be undertaken by the Joint Authority, mainly in accordance with the scheme submitted by the promoters, but subject to modifications, and with provision that further modifications thereof may be made with the approval of the Commissioners; (*c*) requiring the Joint Authority to submit within a period of two years from the date of its formation proposals for securing a supply in unoccupied areas where there is a reasonable prospect of such supply being remunerative.

The Commissioners desire that the promoters should continue, pending the establishment of the Joint Authority, to act as a Provisional Committee with which they can consult. They further hope that the Walsall Corporation will assist by joining the Provisional Committee.

North Lancashire and South Cumberland Electricity District.

Concerning the evidence given at the inquiry§ held in January, 1922, at Barrow-in-Furness into the scheme submitted by the Provisional Joint Committee for the North Lancashire and South Cumberland Electricity District‖ the Commissioners have arrived at the following conclusions:—

> The survey which has been made as the result of the provisional determination of the district has shown that from engineering and economic points of view the district is too scattered for immediate development as one electrical area under the control of a Joint Electricity Authority, and that no practical advantage would accrue from the formation of such an authority at the present time.
>
> The formulation of the scheme¶ and the inquiry have, nevertheless, served a useful and practical purpose by showing that improvements in the organisation for the supply of electricity can be brought about in certain portions of the district, namely, (*a*) by an extension of the electrical activities of the Corporation of Barrow-in-Furness to cover a wider area of supply; (*b*) by a measure of consolidation in the Lancaster—Morecambe—Heysham area; and (*c*) by a development of supply in the Millom—Bootle area.
>
> The Commissioners are prepared to give favourable consideration to proposals from the parties respectively concerned for bringing about such improvements under Special Order procedure. Such proposals should be so framed, and will be so controlled by the Commissioners, as to aim at an eventual combination of the three areas into one district.

The Commissioners have accordingly decided that it is not necessary or expedient at the present time to proceed with the final determination of the district or to make an Order establishing a Joint Electricity Authority. The district will, however, remain provisionally determined, and the position will be reviewed at a later date in the light of the developments then accomplished.

THE BALTIMORE OIL CIRCUIT BREAKER TESTS.

In view of the tremendous growth of electric power systems it has been realised for some time that much of the old switchgear is not adequate for the increased duty it is called upon to perform; there is also considerable uncertainty as to the actual rating of many of the more modern types of circuit breaker. This state of affairs can be attributed to the fact that the manufacturer is unable to test his product under the conditions under which it has to function in practice.

These circumstances induced the Consolidated Gas, Electric Light & Power Co., of Baltimore, and the Pennsylvania Water & Power Co., U.S.A., to carry out elaborate oil circuit breaker tests on their interconnected 13,200-volt, 25-cycle power system, in co-operation with the Westinghouse Electric & Manufacturing Co. and the General Electric Co., which furnished the switches tested. Generator, transmission line and cable capacities were furnished equalling normal operating conditions and the currents obtained during the tests exceeded those usually met with in short circuits on this system. All the tests were made by throwing "dead" metallic short circuits on the entire connected system, which the breaker under test was called upon to open.*

The Canton sub-station in Baltimore was selected as the best location for these tests for several reasons: It is situated about seven miles from Westport, the main steam generating station of the Consolidated Co., and about 41 miles from the hydraulic power plant at Holtwood of the Pennsylvania Water & Power Co. and power could thus readily be supplied from both of these generating stations over a large number of cables and transmission lines, being in this way well distributed on the generators, transformers and feeders, without excessive overloading of any individual units.

Actual test results showed the great effect of sustained voltage; the voltage at Canton, *i.e.*, the re-established voltage, appearing immediately after the short circuit was cleared was never less than 77 per cent. of the normal voltage, even after the heaviest short circuits obtained, and on lighter short circuits was pricaically normal.

The main station at Westport has a generating capacity of 127,500 kW in steam-driven turbo-generators, of which 87,500 kW was usually available for the tests. The generating station at Holtwood, Pa., has a generating capacity of 83,500 kW in water-driven units. There is also one 20,000-kW steam-driven unit at the Pratt Street station in Baltimore. These three generating stations are interconnected through a number of sub-stations, giving the system a combined generating capacity of 231,000 kW. The maximum generating capacity used in the tests was 170,000 kW. Canton sub-station is directly connected with the Westport steam station by four 26,000-volt submarine cables, banks of transformers being provided at either end, and is also tied to the city network by eight 13,200-volt cables through the Pennsylvania Water & Power Co.'s Highlandtown sub-station.

To obtain short-circuit currents of different magnitudes the number of generating units was varied to some extent, but the main variation was obtained by changing the cable connections between the generating stations and the test bus at Canton sub-station so that even in the case of the minimum current used a very large capacity was behind the short circuit.

It is of interest to note that the calculated short-circuit currents were found to be within from 5 to 15 per cent. of those actually obtained during the tests at the time of rupture.

All the tests were made at 13,200 volts, 25 cycles. Short circuits ranging from 950 to 30,800 initial r.m.s. amperes and from 750 to 23,700 ruptured r.m.s. amperes were obtained. The water-power station being far removed from the test bus supplied about 30 per cent. of the initial short-circuit current, 70 per cent. being supplied either by Westport alone or by the Westport and Pratt Street stations. The maximum instantaneous loads on any of the generators did not exceed five times the normal load. Under the heavy short circuits, some cables (4/0) carried from 2,000 to 2,500 amperes.

Most of the short circuits were made across all three phases and ground. A few were across two phases and ground, and several on one phase and ground only. Two-phase and single-phase short circuits produced severe vibration of the turbo-generators. In this connection it should be pointed out that in the Baltimore system the neutral of all generators and transformers is "dead" grounded without any resistance, so that in each three-phase test it was necessary for each individual phase of the oil-circuit breaker to clear its own part of the short circuit without any help from the other phases, as might have been the case in any ungrounded or partially grounded system.

The general method of testing was to throw a dead short circuit on the breaker under test. Two others were in series with the test breaker serving as protective breakers in case of the failure of the test breaker, being set for later opening. A separate switch was used to act as a closing-in breaker exclusively.

The breaker under test was next to the short-circuit connection, which provided a metallic short circuit between all three phases and ground. It was arranged to trip automatically by means of a plunger type relay with "instantaneous" time setting, the only delay being that due to the inherent characteristics of the mechanism and relay. This varied from three to nine cycles (0.12-0.36 sec.).

In no case did the protective breakers fail to clear the test equipment from the bus in the station.

Magnetic stresses produced by heavy short-circuit currents caused a great tendency of leads to shift and whip, sometimes resulting in breakdowns; also very careful attention had to be given to soldered joints and connections, as repeated heating and pulling action caused defective joints to open up with consequent arcs, which sometimes spoiled the tests and often damaged other parts. Not only did this pertain to the connections in the test sheds, but it was also of special importance in the leads in the station connected with the test, in order to prevent trouble being communicated to the rest of the station.

Three oscillographs containing three elements each were used, a total of nine elements and three films.

By far the larger percentage of the short circuits seemed to break the arc at the zero point of the current wave corresponding to the time at which the magnetically stored energy of the system was a minimum.

It is interesting to note that it has been possible to make a total of about 200 short circuits directly on the Baltimore

§ Elec. Rev., p. 187; February 10th, 1922.
‖ Elec. Rev., p. 721; December 3rd, 1920.
¶ Elec. Rev., p. 230; August 12th, 1921.
* *Journal* of the A.I.E.E., June, 1922. (*Abstract.*)

system at Canton, many of which involved the largest short circuit obtainable at this place without any breakdown whatever of the major equipment of the two operating companies, and with no more than two serious disturbances resulting to the system, one being due to the opening of a disconnector in the station, and the other being caused by the burning open of one of the leads in the station at its terminal. All the tests naturally meant momentary voltage disturbances to the system, and for this reason most of the tests were made after midnight or on Sunday morning when such momentary disturbances could best be tolerated. In some of the later tests the load of a number of the more important customers was also carried on separate generators during apart from the tests. In no case did the generators fall out of step, and in only a few cases was any of the customers' synchronous load lost momentarily. The most sensitive equipment on the system seemed to be the rectifiers used for street lighting which frequently would drop out, but as these could always be restarted immediately, this was not considered of serious consequence. The chief reason for the fact that it was possible to make so many short circuits with so little serious interference with the system lies undoubtedly in the short duration the short circuit was permitted to hang on to the system. usually not more than ½ second and never more than ¼ second. Additional reasons may be the fact that short circuits were not made directly at the generating stations so that there would always be some voltage left on the generators to maintain synchronism, and the fact that the system in question is equipped with a carefully designed and adjusted selective relay system.

The individual performances of the breakers shows that the tests have resulted in marked improvements in the design and performance of oil circuit breakers for moderate voltage and high interrupting capacity. The results unquestionably indicate that it is possible, with proper design, to build oil circuit breakers which can be relied upon to satisfactorily interrupt large currents on high-capacity systems many times in succession without damage to the breaker, without any oil throw, and without change of oil or adjustments.

The tests have also proved that it is possible to conduct a series of test directly on a modern system without damage to equipment and without serious interference to its normal operation. It is hoped that this fact will encourage other operating companies to co-operate with the manufacturers in further improvements of oil switches of other designs and ratings to the benefit of the whole industry.

THE SPANISH MARKET.

New Tariff Agreement.

At long last the seller of British goods in Spain now has a definite assurance of his position during the next three years at least. The lengthy negotiations which have been carried on in Madrid for many months have resulted in the agreement of a new draft commercial treaty between Great Britain and Spain, and there is little doubt that it will be ratified. Thereunder the former benefits by all reductions in import duties granted to any other country and also by special reductions in the duties on a number of articles contained in the lower of the two existing schedules. On the whole the British negotiators are to be congratulated on a successful issue, for although the Spanish duties on British goods remain frankly protectionist, they stand in a better position than that in which they have been placed for very many months. During all this period uncertainty, as well as the heavy tariff, has crippled British trade. For the next three years, at any rate, those engaged in the sale of United Kingdom manufactures in Spain know that they are as well placed as any of their competitors other than the Germans. The rivalry of the latter has, however, been checked by both the anti-dumping measures adopted by Spain and also by the fact that German manufacturers can give but poor deliveries.

With regard to the various rates of duty comprised in the new Anglo-Spanish convention, the complete schedule will not be made known until the agreement is made effective. It is clear that the import duties on electrical and allied goods will not be higher than those shown in the following table. By way of comparison, the rates formerly in force are shown side by side with the new rates.

Tariff No.	Articles.	Former rates. Pesetas.	New rates. Pesetas.
29	Asbestos, manufactured (100 kg.)	150	120
70	Glass insulators ... (100 kg.)	30	24
506	Steam engines, weighing more than 10,000 and up to 50,000 kg. ... ... (100 kg.)	69	62
507	Ditto, more than 50,000 kg. (100 kg.)	40	32
510	Steam turbines, weighing 10,000 to 25,000 kg. ... (100 kg.)	35	32
	Ditto, more than 25,000 kg. (100 kg.)	35	29
516	Electric locomotives (100 kg.)	100	80
	Electrical machinery, weighing:		
624	500-1,000 kg. ... ... (100 kg.)	120	108
625	1,000-3,000 kg. ... (100 kg.)	75	67
626	3,000-5,000 kg. ... (100 kg.)	50	45
627	Over 5,000 kg. ... (100 kg.)	45	36
or 629	Electric installations, weighing more than 1,000 kg. a.v.	20%	15%
633	Circuit breakers, weighing:		
	1-100 kg. ... ... (100 kg.)		90
	100-1,000 kg. ... (100 kg.)	100	80
	1,000-5,000 kg. ... (100 kg.)		60
	Over 5,000 kg. ... (100 kg.)		40

When, shortly after the Armistice, the United States Government investigated the market for electrical goods in Spain, the conclusion arrived at was that notable developments would occur there because of Spain's ample water-power resources and the relatively small extent to which electricity had been used in the past by the masses of the people.

This conclusion is as sound to-day as it was then, and, in view of the particular interest which the Customs tariff negotiations have lately given to the Spanish market, it will be useful to examine further some of the sections of the American Trade Commissioner's exhaustive report.

With regard to local manufacture, it is not precisely known when this commenced, but there are factories in Madrid and Barcelona that have been in continuous operation for 20 years. Nearly all are very small and make a limited quantity of material, but, during the war, methods were improved and capacity was increased to a considerable extent. The greatest advance has taken place with lamps and wiring devices. Nearly all forms and sizes of drawn-filament and gas-filled lamps are made of a reasonably good quality. The other more important manufactured articles are generators, motors, transformers, meters, insulated wire, storage, and dry batteries, heating and cooking devices, insulators, and carbons.

In connection with lamp manufacture, filament and entrance wire is imported. English wire has been offered for sale, and has given very good satisfaction at lower prices than American wire. All the glass parts are made in Spain. There is a chance of business in furnishing replacement plant and equipment for the lamp factories.

Wiring conduit of the Bergmann type is made in sufficient quantities to fill local needs and also create a surplus for export. The manufacture of wire and cable has been considerably stimulated by the protective import tariff. There are at least six well-equipped works, whose output meets all local requirements.

With regard to motors, upwards of five works are a factor in the market, apart from numerous small shops. The former group claims to be able to produce machines up to 500 h.p. The total capacity of the industry is not equal to all demands, and a number of projects are on foot for establishing electrical works. Motors suitable for direct connection to pumps and ventilating fans are made, but few special types, such as traction or fractional horse-power motors.

Despite a certain amount of local production, there should continue to be favourable opportunities for the sale of foreign-made generators, transformers, meters, switchgear, and controllers.

Industrial Expansion

Because of its natural resources, Spain is potentially an enormously rich country. Mines are being opened, agriculture is being extended, and the metallurgical industries have so developed that steel and iron shapes, beams, boilers, rails, locomotives, and ships are constructed in various cities and ports. The manufacture of sugar (both beet and cane), cotton and woollen cloth, and a great variety of machinery and articles needed in everyday life has been greatly stimulated during the last four years. All these things require power to drive the factories, as well as increased facilities for handling the freight involved in the movement of raw materials and finished products. Whereas coal furnished nearly all the power of earlier days, war-time difficulties of supply opened the eyes of the capitalists and engineers to the possibilities of the hydraulic energy present in all districts. The demand for this has been so insistent that companies which have been in operation a few years have been forced to expand their capacities, even in times when the great difficulties of securing capital or equipment would normally dictate a policy of

inactivity in this direction. New companies are being formed to exploit concessions that have been dormant for years, as well as the concessions that are being issued now, covering streams both large and small.

With all of this movement attention is naturally being drawn to the advantages of electricity for a multitude of uses, such as heating, chemical works, and traction, whereas previously it was employed for lighting only. In this manner a demand is being created for everything electrical for the factory, the shop, and the home. This demand must increase with the availability of a greater amount of relatively cheap energy and the consequent canvassing on the part of the central stations for a larger load. The opportunity for selling such material is now open to all, and those who are first to enter the field in earnest by catering to the peculiarities of the market with respect to designs, credits, and terms of payment will reap the greatest reward in the future.

Competition is severe in Spain and quite out of proportion to the importance of the market. Every well-known European factory is represented either by an office of its own or by agents or travelling salesmen; nearly every American manufacturer has given his agency to some local firm, and, in addition, there are a number of national factories that turn out very creditable goods in increasing quantities. These last are able now to supply practically the entire demand for incandescent lamps, insulated wire, and wiring devices, and are making inroads in the business heretofore obtained by importers of motors, heating apparatus, fans, and insulators. In order to meet this situation, it will be seen that the representative must be selected with care and then backed up by an enduring policy of assistance, with competitive prices, good deliveries, and satisfactory terms of payment.

Branch Factories.

There is a chance for the investment of capital in large enterprises, but this will have to be done in conjunction with local bankers. Technical assistance is needed more than money at this time, and an organisation combining engineering skill with large financial resources could undoubtedly start many projects, such as railway electrification, hydro-electric plants, or manufacturing establishments, and immediately secure plenty of capital to carry them through. This procedure is more desirable than an attempt to do the entire work alone, as there is a tendency towards Spanish ownership or control of all enterprises of any magnitude, and a well-defined feeling in most quarters that only Spanish capital should develop Spanish resources. This is the modern spirit and differs radically from the old idea of simply depositing surplus funds in the vaults of the Bank of Spain or purchasing farm mortgages. All that capital needs now is someone in whom it has confidence to point the way and take the initiative.

Two or three months ago the American Consul at Barcelona reported on the favourable conditions which existed in his district for the sale of electric heating and cooking apparatus. On account of the climate, the high cost of gas, and the unpopularity of oil stoves, the electric heater should be easy to sell in increasing numbers. The opening of several new power stations is expected to lead to a cheapening and more extended use of current. The market is accordingly well worth investigation. The voltages in use in the Barcelona district are 110/220, 125/220, and 150/300. In general the a.c. service at 120/220 V is supplied throughout the district; electric heaters, therefore, equipped for a voltage of 120 or 125 to 225 could be used.

A LARGE CONDENSING PLANT.

A large up-to-date surface condensing plant has recently been completed by Messrs. Cole, Marchent & Morley, to the order of the Corporation of Leeds, for installation at the Whitehall Road electricity works in conjunction with a 12,000-kW, B.T.H. turbo-generator.

The condenser is a vertical one of special construction, and is designed to deal with 220,000 lb. of steam per hour, maintaining a vacuum of 28.5 in. with the barometer at 30 in., and with cooling water at a temperature of about 65 deg. F. The following particulars will give the reader an idea of its magnitude: Area of cooling surface, 46,000 sq. ft.; quantity of circulating water required 2,400,000 gal. per hour (twice that of the total Bradford town supply); shell, including top and bottom water-circulating boxes, 34 ft. high and 11 ft. from side to side; overall dimensions of plant, including exhaust connections and pipework, 58 ft. from back to front, 35.5 ft. high, and 46 ft. from side to side; exhaust opening 12 ft. high and 6 ft. wide; circulating water outlet 42 in. diameter; weight of condenser with pipe work, tube plates, tubes, pumps, &c., 220 tons; and there are approximately 31 miles of tubes.

So as to avoid deep foundations or an excessively high engine-house, the exhaust inlet has been arranged on one side, and the connection to the turbine exhaust outlet is made by a curved adapting pipe with a copper expansion pipe immediately below the turbine exhaust. This arrangement means that the turbine and condenser are side by side, and the top of the circulating water inlet box is at approximately the same level as the top of the turbine.

At the top of the condenser is a deep open box having three connections on one side for the circulating water inlet, outlet connections and weir with a grid box on the other side for an overflow pipe. Gates or dividing plates are fitted in this box to enable the circulating water to flow twice through the tubes when required. For single flow these gates may be raised, and suitable gear is provided which is operated from a platform surrounding the top of the condenser. The centre portion of the condenser, forming the actual condensing chamber, is arranged with the exhaust steam inlet at one end, and the air outlet branches at the other, two of which are supplied, one at the top and one below the centre division of this section, a further branch being arranged at the bottom for connecting to the extraction pump.

A feature of the condenser is the method of staying. There are 48 lateral stays, each 1.5 in. diameter, contained in a cast-iron tube, the tube being a fit between the two sides of the condenser. Four cross girders arranged laterally act also as stays to the condenser shell, and support the tube plates both at the top and bottom. In addition to the lateral stays there are vertical stays to tie the top and bottom tube plates together, the supporting plate in the centre being secured to these stays by means of collars.

The tube plates are of brass, the top one being 15/16 in. thick and the bottom one 1 3/16 in. thick. Each is built up of six sections, and above the top plate a guard plate 1¼ in. thick is fitted, having special bell-mounted openings exactly coinciding with the holes in the tube plate. This is a special provision to meet the presence of foreign matter in the circulating water. The tubes are of 1 in. internal diameter of solid drawn brass and 18 s.w.g. thick, expanded into the top plate and fastened in the bottom plate by cotton tape packings and screwed ferrules.

The base of the condenser forms a water box and settling chamber, having a branch at one side for the circulating water inlet for use when it is desired to convert the condenser into a two-flow. At one end circulating water outlet branches are provided, and in addition there is another branch so that sludge and dirt can be flushed out as required.

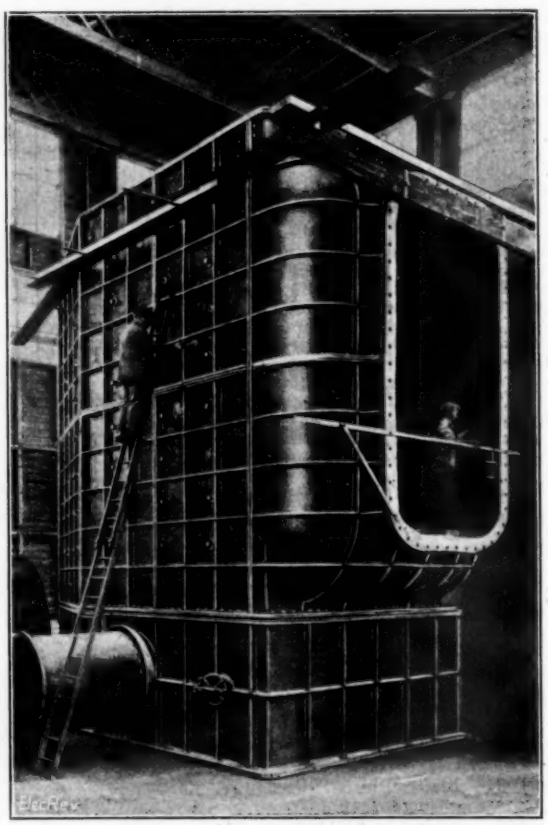


Fig. 1.—Condenser for Leeds Corporation, Fitted with "C.M. & M.-Delas" Air Extractors.

As will be seen from the illustration (fig. 1), the condenser is built up of cast-iron plates, each being ribbed to withstand external pressure.

Air extraction is carried out by three sets of "C.M. & M.-Delas" steam jet air extractors of the intermediate condenser type, described in the ELECTRICAL REVIEW of October 21st, 1921 (p. 551), two of which are sufficient to deal with the air to be extracted, the third acting as a spare, and these are arranged at the end of the condenser opposite the exhaust branch with a special platform and ladder to ensure easy access to them.

The main feature, which is the basis of the "Delas" patent, is the water jacketing of the combining tube, which results in obtaining a convergent-parallel as against a convergent-divergent combining tube. By continuing the water jacketing to the lower end of the tube, and altering from divergent to parallel, a condensing effect is obtained on the walls of the diffuser, thus effectively ensuring the tube section being full,

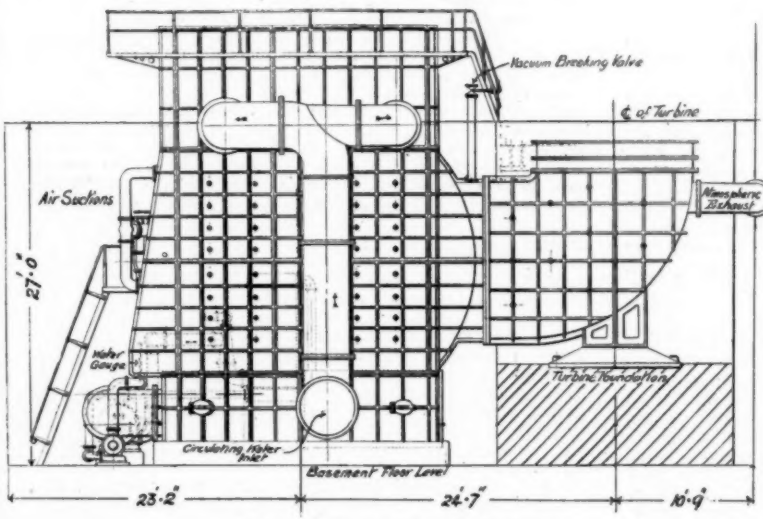


FIG. 2.—ELEVATION OF CONDENSER.

and preventing the formation of eddies or vacua, and therefore absolute stability is obtained, notwithstanding alterations in load and/or steam pressure. Further, the compression throughout practically conforms to the theoretical isothermic curve, which results in a considerable reduction in steam consumption over other steam jets for a similar duty where the compression follows the adiabatic curve.

There are two extraction pumps of the multi-impeller centrifugal type, one of which, together with a multi-stage rotary boiler feed pump, is driven by an auxiliary turbine developing 102 b.h.p. at a speed of 2,500 r.p.m.; the other is direct coupled to its own electric motor.

The main feed tank or hotwell measures approximately 10 ft. by 10 ft. by 6 ft., and the boiler feed supply tank is 6 ft. by 5 ft. by 6 ft.; both are built up of cast-iron plates.

In connection with these two tanks there is a 6-in. Venturi meter with integrating and recording mechanism, having a range of from 3,000 to 25,000 gal. per hour, with by-pass and valves to enable it to be isolated when required.

The circulating water is pumped from the River Aire through a 42-in. diameter inlet pipe up to the top box of the condenser, and after passing through the tubes to the lower box, it drains back into the river by gravity. The drawing (fig. 2) gives a good idea of the general arrangement of this pipework.

The feature of the "C.M. & M.-Delas" steam jet air extraction principle is that about 85 per cent. of the heat in the steam operating the jets is recovered by heating the water for boiler-feed purposes. With the plant in question both the auxiliary turbine exhaust and the exhaust from the "C.M. and M.-Delas" air extractors pass through a feed-water heater, which is of the surface type having a cast-iron casing with ¾ in. dia., 18 s.w.g. solid drawn brass tubes, and is situated in a convenient position on the side of the condenser, near the auxiliary turbine and air extractors.

Electricity in French Agriculture.—Having surplus power at its disposal the Orleans Railway Co., on the recent occasion of agricultural meetings held at Poiters and Limoges, drew the attention of agriculturists in the centre of the company's system to the advantages of the use of electricity in the field and in the farm buildings. Continuing this effort the railway company has now organised an exhibition at a congress to be held at Brive next week of agricultural and farm machinery driven by electric motors, including pumps and irrigating plant.

ELECTRIFICATION OF NETHERLANDS RAILWAYS.

COMMISSION'S REPORT.*

In January, 1920, the Minister of the Department of Buildings and Roads and the Board of Managers of the Netherlands' Railways appointed a commission to report on the relative desirability of the different systems available for the electrification of railroads. The commission was to base its decision upon the gradual electrification of the entire railway system. This point was considered of special importance because of the relatively small area of the country, and the confusion that would be caused by the installation of different systems.

At the time this commission was formed only two countries could be said to have officially selected a uniform system of electrification; these were Switzerland and Germany, both of which had selected single-phase alternating current. In Sweden this system was also tentatively chosen, but later, on account of the certainty of interference with communication lines, a new investigation was started of the direct-current system.

In England, France, Belgium and Italy commissioners had reported since the Netherlands' commission was first appointed. The following are recommendations made by these several commissions: England, 1,500 volts direct current; France, 1,500 volts direct current (with 3,000 volts for some lines); Belgium, 1,500 volts direct current; Italy, three-phase in the north and direct current in the south.

During the period from February to September, 1920, the members of the commission visited various countries, inspected the several railway systems, and interviewed railway and electrical experts in England, Switzerland, Germany, Sweden and the United States. The question was studied, both from the point of view of the general electrification of railways and industries, and from the point of view of electrifying the roads alone. If the railways were to be electrified on the single-phase system in would be necessary to provide electricity at a frequency of 16⅔ cycles. Studies were made as to the relative desirability of using steam turbines with generators of two frequencies on the same shaft or the employment of frequency-changer sub-stations for all of the railway service. It was the opinion of the commission that the double frequency generating scheme was impracticable, and that the most satisfactory solution required the transmission of all energy at one frequency and over the same transmission lines.

The report makes a careful analysis of the factors entering into the choice of system and the following points are outlined in the "Interim Report":—

The three-phase system has more advantages for mountainous countries, but has the disadvantage of requiring two trolley wires, while the three-phase motor is less adaptable to the demands of railroad service. The combination of a national electricity supply system with distribution of power to the railroads offers more advantages with d.c. than with the single-phase system. Overcoming the disturbances in communication lines caused by single-phase supply has not been done satisfactorily; therefore, it cannot be decided in advance what protective measures (assuming a minimum cost) will be sufficient to ensure operation in a manner satisfactory to all reasonable requirements.

It was the unanimous opinion of the commission that the direct-current motor was more simple and reliable than the single-phase type, especially at moderate direct-current voltages, although the single-phase motor has been much improved in recent years. The commission, therefore, is of the opinion that for the Netherlands the direct-current system must be recommended. The potential to be selected lies between 1,500 and 3,000 volts. So far as can be seen at present a potential of 3,000 volts will not be necessary, in view of the short distances between feeding points and the weight of trains to be handled.

The general comparisons cited in the final report between the two available sytems are as follows: The influence on the weak current lines is of special importance in view of the limited space on the railroad, the large number of wires and the difficulty of finding another place for them in a thickly-populated district. The comparatively small distances between the junctions would not give the possible h.p. single-phase system the proper advantage. In connection with these short distances and the density of traffic at the time of electrification the difference in cost of construction and operation will not be very great. The development of automatic sub-stations and the use of mercury rectifiers offers

*From the *General Electric Review*.—Abstract.

more probability of improvement to the entire direct-current system than to the single-phase system. With direct current a greater possibility exists, in general, that a considerable part of the equipment that will be necessary can be manufactured in the Netherlands.

The following summarises the conclusions reached: While it is uncertain whether or not a national electricity supply system will be established, the commission believes that in any case the generating of electricity will have to take place at a frequency of 50 cycles. If a national supply system is not established the Holland railways must be electrified with direct current having an operating potential of 1,500 volts.

THE GLASGOW ELECTRICITY UNDERTAKING.

Annual Report.

We have received from the engineer and manager of the Glasgow Corporation electricity undertaking (Mr. R. B. Mitchell) a voluminous report upon the working of the department during the year ended May 31st, 1922.

The revenue account shows that the total income fell from £1,311,951 to £1,191,438, while working expenses were £739,481, as compared with £969,586 in 1920-21. The decreased revenue was mainly due to lower sales, the scale of charges remaining the same. Generating costs showed a remarkable reduction, from £622,070 to £343,377, and all other items were less than in the previous year with the exception of the amount written off for depreciation which was £118,998 as against £67,161 in 1920-21. Fuel costs were almost exactly halved, the figures for the two years being £468,096 and £235,643. The gross profit for the year was thus £451,957, as compared with £342,365. Against this were debited capital charges totalling £409,379 (£339,635), and the net result was a profit of £42,578—over fifteen times that of the previous year, £2,730. This profit was transferred to the reserve fund, bringing the latter up to £58,821.

The capital value of the undertaking is stated at £6,138,917. The principal items of expenditure on capital account during the year were in connection with the Dalmarnock station:—Additional land and buildings, £33,435; machinery and plant, £173,272; and accumulators, £511. Other large items were Kinning Park sub-station, £29,769; Cadogan sub-station, £70,645; Elliott Street sub-station, £45,587; Buchanan Street sub-station, £25,158; Partick sub-station, £24,833; and mains and cables, £283,556.

The quantity of energy sold was 131,341,783 kWh, as against 154,175,830 kWh in the previous year. The decrease is shown under the heading "Private Consumers." The maximum demand was also lower being 69,900 kW, as compared with 76,964 kW in 1920-21. Connections increased by 7,749 kW to 173,272 kW.

The report states that there are now four 18,750-kW sets installed and in operation at Dalmarnock, and a fifth will be on load during the coming winter. This completes the first half of the works. No. 2 boiler house has been completed; the boiler plant at the works consists of sixteen boilers each of 50,000-lb. evaporation capacity.

In future the Port Dundas station is to run for 10 hours a day only, and no further additions will be made to the plant. The use of the generating plant at the Pollokshaws Road station has been discontinued, converting plant only being in operation. During the year the Elliott Street and Riddrie sub-stations were put into commission, and the following are in course of construction:—Cadogan Street, Buchanan Street, Kinning Park, Alexandra Parade, Bridgeton, Craigton, and Mosspark. The cables laid during the year comprised 5¼ miles of l.p. feeders, 8 miles of h.p. feeders, and 7¼ miles of distributors on the north side of the Clyde; and 1¾ miles of l.p. feeders, 4¾ miles of h.p. feeders, and 5¼ miles of distributors on the south side of the river.

Anticipating a favourable result from the present year's operations, the Electricity Committee instituted a schedule of reduced charges at the beginning of the year. For lighting the general reduction is 1d. per kWh; for power ½d. per kWh; and for heating other than domestic ½d. per kWh. The domestic rates are now:—Lighting, 4½d per kWh, and heating, &c., 1d per kWh special rate and 2d per kWh ordinary rate.

Wages in the Tramway Industry.—The proposal of the employers' side of the National Joint Industrial Council for the Tramways Industry to terminate the existing sliding-scale agreement on September 21st has given rise to protests from the men in most districts. At Sheffield, Birmingham, and Bradford resolutions to take all necessary action to resist the imposition of wage reductions have been passed. At Newcastle a meeting was held to explain the position to the employés. As the Corporation is not a member of the N.J.I.C. local arrangements were suggested. An agreement embodying a compromise has been arrived at between the Manchester City Council and its tramway employés.

REVIEWS.

The Electric Furnace. By J. N. Pring, M.B.E., D.Sc. Pp. xii+485; figs. 241; plates XIX. London: Longmans, Green & Co. Price 32s. net.

The Electric Furnace. By Frank J. Moffett, B.A., M.I.E.E. Pp. x+118; figs. 33. London: Sir Isaac Pitman & Sons. Price 2s. 6d. net.

It is now over 30 years since the electric method of furnace heating first emerged as an industrial possibility, but partly due to natural causes, and partly to our inherent conservatism the method has certainly not attained in this country the extended use that was once expected of it; a failure all the more striking in view of the fact that some of the earliest electric furnace work was carried out in England. The war however, gave a great impetus to the adoption of electric furnace heating, notably for the refining of steel and the fixation of atmospheric nitrogen, and it may be hoped that the fallacy which it is one of the objects of Dr. Pring's book to dispel, namely, that the electric furnace can only be employed in countries blessed with an abundance of water-power, will no longer operate to prevent the development in England of so important and powerful a method of energy-transformation. In making the comparison between the cost of fuel-heated chemical processes and those in which electric heating is employed, the fact is too often overlooked that in the former a considerable proportion of the energy generated is carried away to waste in the flue gases, and a further large proportion is utilised in heating furnace or crucible walls. From the energy standpoint the essential feature of electric heating is that the energy is applied *internally* in the body of the furnace charge, and its amount can be regulated to a nicety. From the chemical standpoint it has the advantage of not producing or requiring any particular gaseous atmosphere. It is where these two principles are appreciated that we find extended application of the electric furnace, and during the last decade it has been above all the steel metallurgists who have realised the value of electric heating in refining their crude product, for it is precisely in this operation that the two characteristics just mentioned are most clearly advantageous.

A considerable part of Dr. Pring's book is devoted to the description of furnaces and processes for the electrical production of steel and ferro-alloys, and the chapters on this subject, which are exceptionally well illustrated with numerous diagrams and half-tone prints, are among the fullest and best in the book. Many, although not all, of the most recent types of furnace are described in some detail, but here, as indeed throughout the book, we should like to have had the space spent on obsolete appliances devoted to a more critical appreciation of the processes which have survived. For example, an account is given of the Hering "pinch effect" furnace; but we have no indication whether, or if at all to what extent, the principle has been applied in practice. We are under the impression that several Hering furnaces are at work in America. Much of the recent success obtained with electric steel furnaces has been a result of improvements in their regulation, a possibility which gives electric heating a great advantage, but practically nothing is said on this, or on the important topic of electrode manufacture which developed considerably in Great Britain during the war.

A long chapter is devoted to the synthesis of nitrogen compounds from the atmosphere. The subject is of extreme importance and the author has summarised our present knowledge and experience very skilfully. We are of opinion, however, that the editor of the series would have done better to relegate this subject—as well as the companion subject the ammonia oxidation process—to a separate volume. It has little in common, from the industrial or technical standpoint, with ordinary electric furnace processes. As the subject is dealt with, more details should have been given of the recent important developments due to Claude, who has given full descriptions of the remarkable and ingenious points in mechanical design which enabled him to employ a pressure of 1,000 atmospheres in the catalytic chamber.

The electric melting of non-ferrous metals is now attaining much importance in America and here too, notably in the Birmingham district, great progress has recently been recorded. The brief chapter describing this work could be much expanded, and some attention should have been given to its economic aspects.

Among the miscellaneous matters dealt with are such interesting subjects as laboratory furnaces, current supply and transformation and pyrometry; refractories, heat problems and electrode terminals, and, in conclusion, chapters on water power and steam power stations. The author has collected and summarised a very great deal of material, but the small space allotted to some of these important sides of the subject have made it impossible for him to do himself or the subjects justice.

With all its limitations, many of which, by a stricter reference to his subject, we hope to see eliminated in a future edition, Dr. Pring has given us in this volume a very timely and an extremely useful record of electric furnace progress and practice. It is no light matter to cover so wide a field of theory, technology, and industry, and electrical engineers, metallurgists, and chemists will be grateful to Dr. Pring,

and to the publishers of this series, for having given them an up-to-date text-book containing so great an amount of information.

Mr. Moffett's little book is intended to indicate briefly what the electric furnace is and what it can now do; it is in a word an introduction to the subject and it fulfils that purpose extremely well. After a brief—in our opinion quite unnecessary—chapter on electrical principles and one on the history of the subject, the author deals with the characteristics of the electric furnace, explaining its *raison d'être* and its advantages. There follow chapters on arc and induction furnaces for steel and iron and resistance furnaces for miscellaneous purposes. Then we have a shorter chapter on the fixation of nitrogen, and finally a few pages on furnace construction, and a brief bibliography. Given the difficult problem of stating all this in outline in 110 pages, we doubt whether it could be done more efficiently and with less waste of words, and with this comment we commend the book to every engineering student and young engineer who wishes to keep abreast of modern electrochemical and electrometallurgical developments.

General Physics. By Ervin S. Ferry. Pp. xiv+732; figs. 600. London: John Wiley & Sons., Ltd. Price 24s. net.

This is a book designed for the use of students, by the professor of physics of the Purdue University. It is written with a special eye to the industrial applications of the principles set forth, and to this end particular attention is given to the exemplification of each fundamental principle in diverse departments of physics, so that the student may have ample opportunity for gaining a thorough grasp of each principle in its essence, and acquire also, at the same time, practice in applying each principle to problems that occur in practical life as they arise. The method is first to develop ideas new to the student, and then proceed to their precise or scientific expression. The illustrations are chosen from such fields as are most likely to arrest the attention of students. Thus problems of range-finding which became so poignantly interesting during the war are introduced to exemplify several applications of the laws governing light and sound. In compiling a work of this character it is always a difficulty to decide exactly what applications of the several physical laws shall be included. Clearly all the applications that the ordinary affairs of life afford, cannot be introduced, or there would be no putting a limit to the size the book might attain. In this case the writer has leaned towards the useful, as distinguished from ornamental or pleasing applications. Thus the relations of the notes of the musical scale and the problems they involve are not mentioned. Another difficulty is to decide to what degree of abstrusiveness the applications of physical laws shall be pursued. Modern investigations indicate that there is absolutely no limit to the progress of science in this direction. In this case the writer has restricted himself to the presentation of such difficulties as may be elucidated by the help of elementary algebra and trigonometry alone. Hence it is not surprising to discover that neither the word *entropy* nor the word *quantum* is to be found in the index. There is, however, a useful section on the electron hypothesis of electricity. The facts upon which all physicists are now agreed are summed up under nine heads, the recapitulation of which is worth reproducing:—

1.—All electrons have the same mass, and this mass is very small compared with the mass of any atom.

2.—All electrons carry equal negative charges numerically equal to the charge carried by a monovalent ion in electrolysis.

3.—In gases electrons move from a region of low electric potential to a region of high potential, with a speed depending upon the potential gradient and upon the pressure of gas.

4.—A gas is rendered conducting by the passage of a stream of rapidly moving electrons.

5.—The impact of rapidly moving electrons on matter develops heat, light, and mechanical force.

6.—Electrons are repelled by other electrons and by all negatively-charged bodies.

7.—Electrons are attracted by positively-charged bodies.

8.—Electrons in motion are accompanied by a magnetic field, which is in circles having their planes normal to the line of motion.

9.—Electrons are emitted by bodies at a sufficiently high temperature and by bodies at a sufficiently low potential. They are emitted spontaneously by a few substances at ordinary temperatures even when uncharged. They are emitted during some chemical reactions and also by some substances when exposed to X-rays or to light waves of short wavelength. So stated, this seems but a slender foundation on which to rear the elaborate edifice known as the electron hypothesis of electricity.

The reader who contemplates purchasing the book will also be interested to know the relative weight accorded by the author to the several branches of the subject with which he deals. This may be gauged by the proportion of the space accorded to the sections into which he divides it. Dynamics 33 per cent., sound 5 per cent., heat 14 per cent., electricity 25 per cent., light 23 per cent.

A notable feature is the collection of numerical problems by which the student is exercised in applying physical laws. There are nearly 700 of them, and their solution may be strongly recommended to all who make use of the book as they are eminently adapted to dispel the illusions to which every reader of physics is subject, namely, that he fully understands the principles he has read about, when in fact he but partially grasps them.

Pattern-Making. By W. Roland Needham. Pp. 114+v; 171 illustrations. London: Blackie & Son, Ltd. Price 2s. 6d. net.

This is an introduction to pattern-making written for the use of boys who are receiving class instruction in the subject, and is intended to be a companion work to a book on foundry practice in preparation by the same author.

The scope covered by the book is small, the treatment being most elementary and expressed in the very simplest language. Very wisely no attempt is made to teach the manipulation of tools, or the building of patterns in detail, a knowledge of such matters being obtainable only at the bench. The close connection that exists between pattern-maker and moulder is constantly emphasised, the scheme of the book being to explain the principles upon which the arrangement and building of a pattern are based, the reader being encouraged to seek continually for the reasons underlying the methods and means adopted.

The relation between pattern, mould, and casting, is first explained, and is followed by a discussion of the materials and tools used, and of the necessity of allowance for contraction and machining, &c. Simple self-coring patterns are then described, together with the use of loose pieces and drawbacks. The necessity for cores and coreprints, and the building of coreboxes are next dealt with, followed by a description of struck work. Metal patterns and the use of plate patterns complete the book. The examples dealt with throughout the book are of the simplest character, such as brackets, couplings, bedplates, &c., and at the end of each chapter a number of simple questions is set upon the subject matter.

The information in the chapter on tools is somewhat meagre—an explanation of the action of a plane iron, together with a better illustration showing both cutting and cover irons, would have been useful. In fig. 40, which shows a bandsaw, the saw itself has been omitted from the drawing, and figs. 44 and 45, which are intended to show contraction rules for iron and brass, are quite valueless—a full size illustration of a few inches only of each rule compared with a standard rule would have been useful.

The book possesses no special features of interest, but is probably useful for those for whom it is written.

Electrical Machinery. A practical study course on installation, operation, and maintenance. By F. A. Annett. Pp. xiv+431; figs. 491. London: McGraw Hill Book Co. Price 18s. net.

This volume represents the compilation into book form of a series of articles which originally appeared in *Power* between 1917 and 1919, under the title "The Electrical Study Course." In addition, there has been incorporated a number of articles on electrical machinery and operation which have appeared in *Power* during the past seven or eight years. There appears to be a demand in the States for this type of home study course, and, while admitting the existence of a number of good books on elementary electricity and magnetism, the author justifies his book on the grounds that it shows "how theory fits into practice."

There can be no doubt that Mr. Annett believes in getting down to business at once, for in his first chapter fig. 1 represents the cutting of magnetic lines of force by a conductor, and the consequent generation of electric current. Beginning with chapters on elementary magnetism and fundamentals of the electric current we pass on to Ohm's law, series and parallel circuits, energy, work and power, electrical instruments, methods of measuring resistance and sizes of conductors. The principles of dynamo-electric machines are then explained, followed by a chapter on d.c. machine construction, which gives a well-illustrated account of armature and commutator construction, but unfortunately falls back on ancient types in the earlier sections on field-magnet building. All types of d.c. generators and motors are treated fully in subsequent chapters, while starters, three-wire systems, and the parallel operation of d.c. generators are given chapters to themselves.

The a.c. section of the book gives consecutive treatment to the principles of alternating currents, 2 and 3-phase circuits, and the synchronisation of alternators operating in parallel. There is an excellent chapter dealing with power measurements in a.c. circuits, and also with transformers, while chapters on a.c. motors and the starting of polyphase motors complete a book which lacks nothing in thoroughness and is remarkably self-contained with regard to both theory and practice.

The impression gained by the reviewer is certainly not that which is commonly associated with a series of articles re-issued in book form. The treatment is continuous and the book bears the stamp of expert technical writing, and while there may be no exact niche for such a work in this country it will no doubt fulfil a useful purpose among the students for whom it has been compiled.

P. H. S. K.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Skerton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

20,838. "Apparatus for testing high-tension spark circuit of internal-combustion engines. A. Hewlett. July 31st.
20,853. "Electric switches." Northern Electrical Engineering Co., G. Winter and R. Winter. July 31st.
20,876. "Clip-on electric lamp standard." J. C. N. Eastick. July 31st.
20,884. "Crystal detector for wireless apparatus." H. W. Parker and C. J. Siler. July 31st.
20,892. "Electrical couplings." J. C. Chater Lea. July 31st.
20,908. "Determining charge condition of batteries." Cellékay Manufacturing Corporation and A. E. White. July 31st.
20,925. "Rectifier." E. A. S. Vosmaer. July 31st. (Holland, August 1st, 1921.)
20,930. "Electrically controlling bodies at a distance." Soc. Industrielle des Procédés W. A. Loth. July 31st. (France, July 29th, 1921.)
20,936. "Resistance switches." Veritys, Ltd., and W. G. Pipkin. August 1st.
20,940. "Sparking plugs." W. A. Judge. August 1st.
20,941. "Sparking plugs." J. Blacow. August 1st.
20,948. "Induction coil boxes." A. H. Liggett. August 1st.
20,950. "Grid leak condensers, &c., for wireless telegraphy, &c." G. Bechtel, K. F. Karlson and T. McGee. August 1st.
20,963. "Sparking plugs." L. Korczynski. August 1st. (Poland, August 1st, 1921.)
20,972. "Electric transformers, reactance coils, &c." W. Hanna and A. Reyrolle & Co., Ltd. August 1st.
20,974. "Devices for securing external sparking plugs." W. H. Duffett. August 1st.
20,980. "Variable plug socket coil holder." A. R. Fotheringham and H. J. James. August 1st.
20,993. "Means for permitting augmentation of illuminating power of incandescent electric lamps." Soc. Industrielle des Appareils Economiques. August 1st. (France, August 6th, 1921.)
21,009. "Coil holders for wireless telegraphy." W. Lee. August 1st.
21,013. "Electrical marine propulsion." A. B. Field and Metropolitan-Vickers Electrical Co., Ltd. August 1st.
21,032. "Inductances used in high-frequency circuits." Dickinson Electrical Manufacturing Co., Ltd., and M. J. O'Keeffe. August 1st.
21,034. "Receiving telephones for wireless telephony." H. R. Rivers-Moore and R. M. Radio, Ltd. August 1st.
21,041. "Amplification and transmission of sound by microphones." Soc. Coupleue Freres. August 1st. (France, May 8th.)
21,044. "Ceiling mountings for electric fans." Berkeley & Young, Ltd., and J. D. Slater. August 1st.
21,056. "Apparatus for registering pre-determined signal for alarm, &c., purposes for telegraphy, &c." A. C. Fuller. August 2nd.
21,076. "Lighting miners' electric safety lamps." J. R. Linneker. August 2nd.
21,098. "Neutral attachment for arresting high voltage for wireless receivers." J. K. McWhirr. August 2nd.
21,104. "Multi-speed cascade induction motors." L. J. Hunt. August 2nd.
21,108. "Variable condensers for wireless telegraphy." G. F. Barrington. August 2nd.
21,112. "Apparatus for utilising energy of flowing water to produce electricity." F. Horridge. August 2nd.
21,124. "Means for varying electric inductance." H. R. Rivers-Moore and R. M. Radio, Ltd. August 2nd.
21,136. "Sparking plug." H. Ford. August 2nd.
21,139. "Electric permanent safety fuses." E. C. R. Marks (Tutix Akt. Ges.). August 2nd.
21,163. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. August 2nd. (United States, September 7th, 1921.)
21,164. "Electric angle indicators." P. Moltini. August 2nd.
21,173. "Electrically inducing chemical action." W. J. Rickets. August 3rd.
21,177. "Electric spark detectors, &c." J. B. Percival. August 3rd.
21,191. "Rear lamps for motor vehicles." E. Bonell. August 3rd.
21,199. "Electric switches." W. E. Dempster and J. F. Wheat. August 3rd.
21,211. "Microphones." W. K. L. Dickson. August 3rd.
21,235. "Coil for electromotors." C. Lott. August 3rd.
21,246. "Commutating electrical machines." K. Nobuhara. August 3rd.
21,250. "Controllers for electric motors." Igranic Electric Co., Ltd. (Cutler Hammer Manufacturing Co.) August 3rd.
21,251. "Electric capacitance control devices." Igranic Electric Co., Ltd. (Cutler Hammer Manufacturing Co.) August 3rd.
21,254. "Current motors." J. Paterson. August 3rd.
21,259. "Safety devices for electric winding engines, &c." British Thomson Houston Co., Ltd., W. J. Pool and C. J. H. Trutch. August 3rd.
21,285. "Speed regulating method for non-synchronous polyphase motors." Soc. Anon. des Aciéries et Forges de Firminy. August 3rd. (France, August 9th, 1921.)
21,303. "Commutators." P. B. Pickering. August 4th.
21,324. "Sparking plugs." A. A. Petrie. August 4th.
21,341. "Apparatus for automatic control of railway trains." M. R. Gardner. August 4th.
21,347. "Electric controllers." R. H. Barbour. August 4th.
21,348. "Resistance-capacity wireless amplifiers." D. S. F. Adams. August 4th.
21,349. "Wireless transmission for telegraphy or telephony." Q. C. A. Craufurd. August 4th.
21,353. "Electric motor control systems." W. Barbour & Sons, Ltd., and J. M. L. Slater. August 4th.
21,357. "Electromotors." C. Lott. August 4th.
21,372. "Circuit breakers." British Thomson-Houston Co., Ltd. August 4th. (United States, August 4th, 1921.)
21,373. "Control of motors driving planing, &c., machines." British Thomson-Houston Co., Ltd., and R. D. Given. August 4th.
21,377. "Reception of wireless signals." "Soc. Française Radio-Electrique. August 4th. (France, October 11th, 1921.)
21,378. "Means for controlling voltage of alternating current supplied to a valve generator." Ges. für Drahtlose Telegraphie. August 4th. (Germany, August 5th, 1921.)
21,380. "Wireless telegraphy and telephony." J. C. Grant. August 4th.
21,384. "Compensating device for determination of direction of sounds." Atlas Werke Akt. Ges. August 4th. (Germany, August 31st, 1921.)
21,385. "Process of igniting metal-vapour rectifiers." Akt. Ges. Brown, Boveri et Cie. August 4th. (Switzerland, September 29th, 1921.)
21,386. "Rectifying devices." A. R. Angus. August 4th.
21,387. "Electric terminals or binding posts." A. C. Brockies and E. A. Graham. August 4th.
21,388. "Telephone receivers." E. A. Graham. August 4th.
21,393. "Switch apparatus for tramways, railways, &c." D. Arcani. August 4th.
21,390. "Intermittent timed switches for flash signs, &c." H. B. Bullingham and G. H. Tozer. August 4th.
21,403. "Sparking plugs." F. L. Eldridge. August 4th.
21,409. "Automatic or remote controlled rotary converter sub-stations." English Electric Co., Ltd., and G. Schroeder. August 5th.
21,410. "Commutation arrangements in dynamo-electric machines." English Electric Co., Ltd., and G. Schroeder. August 5th.
21,411. "Commutation arrangements in dynamo-electric machines." English Electric Co., Ltd., and G. Schroeder. August 5th.
21,414. "Machine for teaching Morse alphabet by sounds." I. Boulton. August 5th.
21,415. "Aerials for wireless transmission, &c." H. Challis Sowerby. August 5th.
21,429. "Electric heaters, &c." C. E. Garrett. August 5th.
21,433. "Electric diaphragm warning horns." E. C. Browne. August 5th.
21,475. "Safety devices for electrical apparatus." M. Buchholz. August 5th.
21,480. "Publicity sign telegraphs." H. K. Harris. August 5th.
21,481. "Electric storage cells." J. P. Starley and Van Raden & Co., Ltd. August 5th.
21,482. "Coin collecting means for telephones." F. W. Hall. August 5th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

34,411. "Electrical heating elements." R. K. Hearn. June 6th, 1921. (183,148.)
36,116. "Method and apparatus for converting direct current into alternative current by electrostatically-controlled valve oscillators." L. A. Hazeltine. November 28th, 1919. (155,789.)

1921.

1,079. "Receiving systems for radio-dynamic energy." J. H. Hammond, Jun. June 27th, 1917. (157,207.)
1,107. "Switching arrangements for telephone systems with electro-mechanical switches." Ges. für Elektromechanische Telephoneapparate. June 4th, 1914. (157,233.)
1,158. "Conversion of atmospheric electric energy." H. Plauson. March 11th, 1915. (157,264.)
2,330. "Head lamps of motor-cars or vehicles, also applicable to other lamps." W. Slater Greenwood. January 17th, 1921. (183,153.)
2,551. "Electric arc welding applicable for welding studs, tubes, and the like to, or into, metal plates, bodies, and the like." L. J. Steele, H. Martin, and A. E. McCarthy. January 19th, 1921. (183,161.)
5,359. "Insulation of armature windings of electric machines." J. F. Cullin. February 16th, 1921. (183,167.)
5,360. "Wrapping machine more particularly for wrapping insulation round parallel-sided armature or other electrical coils." J. F. Cullin. February 16th, 1921. (183,166.)
5,361. "Insulation of armature windings of electric machines." J. F. Cullin. February 16th, 1921. (183,167.)
5,362. "Machine for positioning armature windings." J. F. Cullin. February 16th, 1921. (183,168.)
5,364. "Apparatus for winding coils for electric machines." J. F. Cullin. February 16th, 1921. (183,169.)
5,365. "Armature testing device." J. F. Cullin. February 16th, 1921. (183,170.)
6,896. "Electrical device for heating liquids and the like." H. J. Preston. March 2nd, 1921. (183,175).
7,712. "Electric arc lamps." Optische Anstalt, C. P. Goerz Akt. Ges., and Dr. G. Gehlhoff. March 10th, 1921. (183,179.)
10,441. "Electric switches." J. B. Tucker. April 9th, 1921. (183,197.)
10,690. "Method of preventing disturbing induction between adjacent leads carrying approximately the same high-frequency waves." H. A. Gill (Deutsche Telephonwerke Ges.). April 12th, 1921. (183,203.)
10,855. "Rail bonds and like electric couplings or connections." J. Mather and W. Walker. April 13th, 1921. (183,209.)
10,939. "Electric starters for internal-combustion engines." Scintilla (firm of). April 14th, 1920. (161,588.)
11,049. "Methods of refining silicon steel and other metals and alloys." British Thomson-Houston Co., Ltd. (General Electric Co.). April 15th, 1921. (183,217.)
11,065. "Gas producers, electric furnaces, crucible furnaces, and the like." Ferolite, Ltd., and H. B. Clapp. April 15th, 1921. (183,219.)
11,069. "High-frequency electrical apparatus." J. B. Bower. April 15th, 1921. (183,220.)
11,105. "Means for employing radio active substances for curative treatment." J. B. Kramer. April 16th, 1921. (Cognate application, 30,944/21.) (183,224.)
11,235. "Electric lamps, particularly adapted to be carried or supported on the person." G. Oldham and J. Oldham. April 18th, 1921. (Cognate application 1,476/22.) (183,233.)
11,238. "Electric switches." G. J. Sutton. April 18th, 1921. (Cognate application 25,824/21.) (183,234.)
11,299. "Automatically-controlled electrical generating plants." M. V. Sclater (Executrix of A. W. Sclater, deceased). April 19th, 1921. (183,237.)
11,457. "Railway signalling apparatus." W. A. P. Cosserat. April 20th, 1921. (183,248.)
11,568. "Electric cooking devices." S. Hnevkovsky. April 21st, 1921. (Convention date not granted.) (163,293.)
11,732. "Electrodes suitable for resistance welding processes." R. F. Woodburn. April 23rd. (183,262.)
11,907. "Electrically-heated kettles and the like." W. Soutter & Sons, Ltd., and W. W. Soutter. April 26th, 1921. (183,264.)
12,273. "Conductors for dynamo-electric machines." Brush Electrical Engineering Co., Ltd., and C. C. Sutton. April 28th, 1921. (183,273.)
14,535. "Automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). May 25th, 1921. (183,304.)
14,543. "Electrical accumulators." G. Philippart. May 31st, 1920. (163,992.)
14,996. "High-frequency electric generators." G. Krawinkel. May 30th, 1921. (183,312.)
16,221. "Electric storage batteries or accumulators." H. M. Genese. June 13th, 1921. (183,329.)
16,227. "Transmitting apparatus for signalling through water." W. M. Thornton. June 13th, 1921. (183,330.)
16,646. "Electrical transmission." A. M. Taylor. June 17th, 1921. (Addition to 170,619.) (183,333.)
17,870. "Means for handling loads on electrically-driven trucks." J. E. Scott and C. D. Cuppiedítch. July 1st, 1921. (183,345.)
18,185. "Sparking plugs for internal-combustion engines." M. L. Parsons. July 5th, 1921. (Cognate application 2,360/22.) (183,346.)
19,222. "Sparking or ignition plugs" S. R. Scilliere. July 17th, 1920. (166,549.)
19,352. "Electrical control systems." R. Brooks and Metropolitan-Vickers Electrical Co., Ltd. July 18th, 1921. (183,354.)
20,624. "Electric fuses and the like." F. A. Ross. August 2nd, 1921. (183,362.)
20,874. "Spark plugs." W. B. Bronander. February 11th, 1921. (175,237.)
21,365. "Apparatus for condensing the mercury vapour in metal vapour rectifiers." Siemens Schuckertwerke Ges. August 19th, 1920. (168,054.)
22,470. "Transformers for high voltages." Haefely & Cie. Akt. Ges. E. March 4th, 1921. (Addition to 170,547.) (176,311.)
27,512. "Electric incandescent lamps and other electric apparatus in which an incandescent filament requires to be kept stretched." Naamlooze Vennootsclap Metaaidraadlampenfabriek "Holland." July 29th, 1921. (183,389.)
28,423. "Electric bed warmer." F. G. Beale. October 26th, 1921. (183,391.)